KALOS® 2 Series

User Manual

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ABOUT THIS MANUAL

This manual describes the Kalos 2 test system from the operator's point of view. Information within the manual explains how to prepare a test station for device testing, load and run device tests, and manage the software system at the test station. Included is a description of the system's architecture, an overview of the software, and instruction on how to use the software tools and utilities.

Scope of Manual

This manual contains information for the Kalos 2 test system. Information in this manual is intended for use by operators, test engineers, and test-site (or system) administrators.

Topics in this manual include:

Kalos 2 configurations—introduction to the Kalos 2 test system. An overview describes the major units, their features, functions, configurations, and information on the Kalos 2 tester hardware, including the test system interface and the test head.

User operations—description of basic user operations, including description of the operating environment, basic system operation, logging on/off and shutdown, and working with files and folders.

Test program definitions—definition for the Kalos Test Language (KTL) and Kalos Pattern Language (KPL), and an overview of the procedures involved in developing a test program file for the Kalos 2 memory tester. Instructions are provided for using the Kedit utility; a Kalos supplied text editor used to generate, edit, and compile test programs.

Introduction to KITE—introduction to KITE software. The functions of the Front Panel, which serves as a graphical front-end to load and control execution of test programs are described. Instructions on how to prepare a device for test, load a test program, and test the device once test system preparations are completed are provided. Also included are basic calibration and diagnostics procedures.

KITE utilities—describes each KITE utility and provides information on function and usage.

Test Debugger—introduction to the Test Debugger application. Information is provided on this interactive utility that allows the user to modify test program components; including flow, sockets, tests, levels, and timing data, within a Kalos 2 test program.

Shmoo and Bitmap tools—an operational description of the Shmoo tool, which includes Pin Monitor and Value Log. The shmoo is used to characterize various parameters of the device under test by creating a graphic display of the relationship between defined parameters over a range of values. The Bitmap tool provides multiple operational modes. These operations include online and offline interactions. The Bitmap viewer displays current (online) cell/address failures of the device under test. This includes two screen displays: Bitmap and MegaMap.

Typographical Conventions

The following typographical conventions are used to represent computer-related information.

Menu Conventions

This manual identifies menu bar submenu commands by referring to both the menu and the submenu item names. For example, instructions to choose the New command under the File menu item are stated as, “select *File* > *New* from the pulldown menu.”

Document Conventions

This	User	Example
courier	Literal text appearing in a program listing (code), or as displayed on a terminal screen.	`area = length * width;`
bold	Software commands entered from the keyboard.	**tar -cvf /dev/rmt/0**
italic	File, directory, and program names.	*Kalos_program.ktl*
=>	A series of a menu selections	Kalos=>File=>Castaldi Project
<Label>	Represents a labeled key on the keyboard	<Return>

Keyboard Conventions

This manual refers to special keys as shown in the following table.

This Key	Means
Arrow	The keys labeled ←, ↑, →, and ↓.
Return	The key labeled Return or Enter.
Alt	The key labeled Alt.

This Key	Means
Control	The key labeled Ctrl or Control.
Shift	The key labeled Shift.
space	The space bar.

Mouse Actions

This manual also uses the following terms for mouse actions. Use the left mouse button unless otherwise instructed.

Instruction	Action
Click	Click the mouse button once.
Select/Choose	Click the mouse button once on the referenced item, so that it is highlighted.
Right-click	Click once with the right mouse button.
Double-click	Click the mouse button twice rapidly without moving the mouse.
Shift-click	Hold down the Shift key and click the mouse button.

Related Publications

The following Credence publications are currently included on the Kalos 2 Series software that is shipped with each system.

- Kalos 2 User Manual - (This manual), Part Number 071-0359-xx
- Kalos 2 KITE Reference Manual, Part Number 071-0455-xx
- ShowBitz ‘Help’ Online Reference Manual
- NVM User’s Guide (Device Interface Board)
- System Monitor User’s Guide

These online help documents are available in PDF format on a CD-ROM that can be read with Adobe® Acrobat® Reader. Refer to the following directory/path: C:\Kalos2\doc\kpl or ktl (make a shortcut to easily access this online documentation). Direct Kalos 2 KITE Reference Manual access is provided from the Kedit utility Help menu. Also refer to the Online Help Documentation section of this preface.

The following Kalos 2 manuals and guides are available on the *Kalos 2 Documentation Set CD*, part number, 063-4790-xx.

- Kalos 2 User Manual, Part Number 071-0359-xx
- Kalos 2 KITE Reference Manual, Part Number 071-0455-xx
- Kalos 2 Service Manual, Part Number 071-0454-xx
- Personal Kalos 2 (PK2) Site Preparation Guide, Part Number 071-0336-xx
- Kalos 2 Site Preparation Guide, Part Number 071-0379-xx
- PK2 Unpacking and Installation Manual, Part Number 071-0477-xx
- Kalos 2 Unpacking and Installation Manual, Part Number 071-0479-xx

Related Manuals:

Microsoft Manuals

- MS Manuals, IEEE

Online Help Documentation

The Kalos 2 documentation set is a collection of Credence manuals and technical documents which have been prepared for online viewing using Adobe Acrobat Reader.

To view the documentation, Adobe Acrobat Reader with Search must be installed on the computer. The 32-bit version of Reader with Search for Windows is included on the Kalos 2 CD. To install it, locate the file named rs405eng.exe and double click on its icon. (Installation instructions can also be found in the Readme.txt file located on the Kalos 2 CD.) Follow the instructions provided by the Adobe installation wizard to complete the task.

To access Kalos 2 documentation, insert the CD into the CD-ROM drive of the computer. If the KITE software installation contained on the CD was run previously, the documentation is already loaded into the Kalos2/doc directory. The documentation can be accessed by selecting the Help Menu on Kedit application or by double clicking on *KITE_Reference_Manual.pdf* or *User_Manual.pdf* files located in the Kalos/doc directory. These files launch the Kalos 2 KITE Reference Manual and the Kalos 2 User Manual, respectively.

Audience

This manual is intended primarily for test personnel responsible for operating Kalos 2 test equipment. Knowledge of the Windows® XP operating software and user interface is required. The goal of this manual is to provide information that enables users to achieve maximum utilization of Kalos 2 test systems in a production environment. This information may also be useful to test engineers who need a quick overview of a Kalos 2 system's architecture and fixturing features.

To supplement this manual, users are also encouraged to participate in the formal training offered by Credence. Classes that cover all aspects of device programming, operation, and maintenance of Kalos 2 test systems are available on a regular basis. Contact your local Credence sales or service center for information and scheduling.

Safety Considerations

This section describes the safety information. This information meets the SEMI S2-93 safety standards as well as those of Underwriters Laboratories (UL), Factory Mutual, Canadian Standards Association (CSA), and VDE (Verband Deutscher Elektrotechniker [Association of German Electrical Engineers]).

Product safety information in Credence Systems manuals serves at least three purposes.

1. It helps prevent injury to personnel.
2. It observes government mandated requirements for safety issues.
3. It complies with the safety requirements in the countries where Credence products are sold.

These requirements apply to instruction, operators, maintenance, and service manuals for semiconductor test systems and associated apparatus manufactured by Credence Systems Corporation.

Safety Statements

Safety statements in this manual are preceded by *Caution*, *Warning*, and *Danger* signs that alert readers of hazards of increasing severity. A description of these hazards is as follows:

CAUTION

A statement with information essential to avoid loss of data, program failure, or equipment damage.

- This statement is not used for a personal injury hazard. The hazard can only result in property damage or loss.
- The hazard is not immediate.
- Safety is contingent upon following the message instructions.

WARNING

A statement with information essential to the safety of the operator.

- The hazard is not immediately accessible.
- One level of protection is present between a person and the hazard.
- The hazard can result in personal injury.

A statement indicating that an imminent hazard exists.

- The hazard is immediately accessible.
- The hazard can result in personal injury.
- Safety is dependent upon awareness and skill.
- No safeguards can be provided.

Operators Safety Summary

The general safety information in this summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

Terms in This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

Terms as Marked on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

Symbols as Marked on Equipment

DANGER—High Voltage ATTENTION—Refer to manual

Protective ground (earth) terminal

Power Source and Ground

This equipment operates from a power source that applies dangerous voltage between the supply conductors and between any supply conductor and ground. If the ground connection is interrupted, all accessible conductive parts could render an electric shock. If a power cord is not provided with the product, refer power connection to qualified service personnel.

Do Not Remove Covers or Panels

To avoid personal injury, do not remove product covers or panels. Do not operate the product without the covers and panels installed. Refer installation to qualified service personnel.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this equipment in an explosive atmosphere unless it has been specifically certified for such operation.

Service Safety Summary

For Qualified Service Personnel Only

Also refer to the preceding Operators Safety Summary.

Do Not Service Alone	Do not service or adjust this product internally unless another person capable of rendering first aid and resuscitation is present.
Use Care When Servicing With Power On	Dangerous voltages and currents may exist at several points in this product or in the equipment with which this product is used. To avoid personal injury, do not touch exposed connections and components while power is on. Disconnect power before removing protective covers and making internal changes.
Do Not Wear Jewelry	Remove jewelry prior to servicing. Rings, necklaces, watchbands, and other metallic objects could come into contact with dangerous voltages or currents.
Power Source	This product is intended to operate from single phase (3-phase for $Kalos_{xw}$) AC power source, 200 - 240 VAC, 40A - 50/60 Hz. The power source may be L1, L2, ground or L, N, ground. Refer to the installation instructions before attempting to connect the product to the power source.
Grounding the Product	The product is grounded through the protective grounding conductor of the power cord (or service wiring in lieu of a power cord). To avoid electrical shock, the grounding conductor must be connected to a properly wired receptacle or junction box.
Replace Covers	To avoid injury to other personnel, replace covers before leaving the equipment unattended.
Lifting	Two or more persons may be needed to lift and maneuver equipment such as test head and rack-mounted units because of their physical size, shape, weight or location. To avoid injury, do not attempt to handle this type of equipment alone.

Electromagnetic Compatibility (EMC) System Requirements

Immunity

The use of hand-held wireless communication equipment should be limited to distances in excess of ten (10) meters from the tester to avoid the possibility of erroneous data or misclassification of devices under test.

Accessibility of ESD sensitive devices and wiring in the vicinity of the test head requires that users wear a grounded wrist strap at all times. Wrist strap ground points are provided at the test head and at numerous points on the main cabinet. ESD wrist strap ground points are identified elsewhere in the system operator's manual.

Other ESD abatement practices should also be implemented such as the use of ESD abatement flooring, conductive shoe straps, ESD preventive coat, ESD wrist strap connectivity monitors, etc.

1

KALOS 2 HARDWARE CONFIGURATION

This chapter provides an introduction to the Kalos 2 tester architecture and system functionality. An overview describes the testers, its features, functions, and configuration. The major units discussed include:

- Test Head
- Server
- Host PC
- Main Board

IMPORTANT — Version Compatibility - Recompile Test Programs

Per the Kalos software release policy, all test programs must be recompiled when upgrading to a major release, i.e., 2.3.x to 2.5. In order to use the 2.5 version of software, all test programs must be compiled with the 2.5 compiler. An error message will be issued at load time if the program was not compiled with the 2.5 compiler. When upgrading a minor release, i.e., 2.3.1 to 2.3.2, or patching an existing release, i.e., 2.3.1 to 2.3.1.1, test programs do not require recompiling.

Introduction

The Kalos 2 test system is a general purpose test system with the additional features necessary to optimally test non-volatile memories, embedded non-volatile memories, and high volume logic. As shown in Figure 1, its small size and highly integrated design optimizes test floor space and lowers the cost of testing. Use of common I/O pins and resources per pin allow testing and programming of logic pattern device tests and standard device under test (DUT) interfaces. Tester-per-DUT architecture allows each device test to proceed independently, maximizing throughput for non-deterministic parallel test flows. Handlers and probers are accommodated by design, with program loading and central control by way of a workstation computer.

Performance features include a 100 MHz basic test rate, per-DUT redundancy analysis, per-DUT AC and DC test. Kalos 2 test systems have the capability to test all future sizes of memory, peripheral logic, and memory arrays of up to terabit data size and
I/O pin counts in multiples of 96 to 768 I/O pins. The test head, with four modules, provides 36 independent test systems, each with 96 I/O pins, for a total of 3456 I/O pins. Each of the I/O pins has individually programmed tri-level voltages, current loads, and comparators.

Each of the possible 36 Kalos 2 test systems in a test head has two dedicated central processing unit (CPU) Modules (ETX). As a result, Kalos 2 has none of the test overhead and restrictions of shared resource architecture test systems, where all devices must wait for the slowest device or when serial binning is mandated. With 36 x 96 pin (or 72 x 48 pin) DUTs simultaneously tested asynchronously in parallel—this sequence independence means each DUT is tested with maximum throughput.

Each 48 I/O pin tester slice has its own CPU module, error capture RAM (ECR), and data buffer memory (DBM) for compatibility with existing Kalos 1 programs. It is possible for one tester controller to control up to four tester slices. In addition, when two 48 pin slices are controlled by one tester controller, any I/O pin can be assigned to any DUT physical pin or ECR pin. For parallel 96 pin tester configurations, the I/O's are in blocks of 96 I/O pins. Complex sequential programming loops and redundancy analysis programs are executed independently, reducing the processor overhead of the test flow to an absolute minimum.

Higher pin count test system configurations are accommodated by a unique controller design that provides software control from one controller to take synchronous master control of up to eight Kalos 2 systems. This allows each test head to be configured as:

72 sites of 48 I/O pins

36 sites of 96 I/O pins

16 sites of 192 pins

Parallel operation of up to eight devices from one tester controller supports 576 DUTS with 6 I/O pins.

The Kalos 2 test system can also be configured in multi-slice mode. Refer to Table 1 for details.

Table 1. Multi-Slice Configuration Data

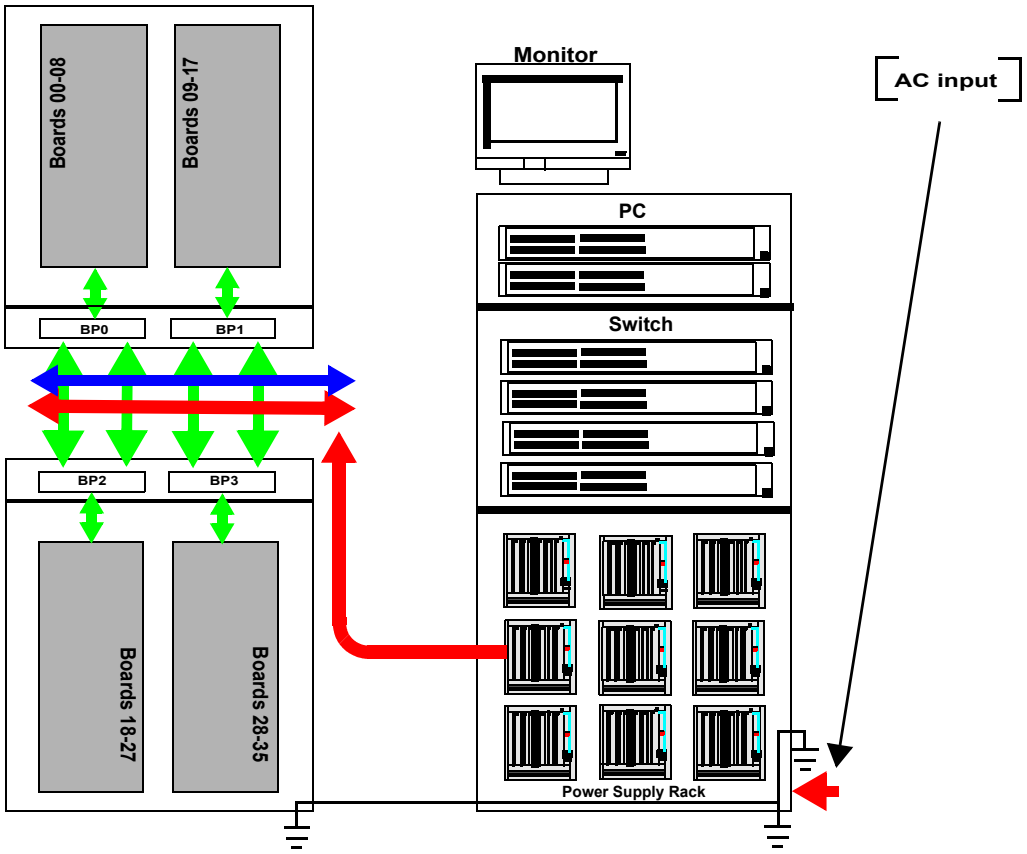
Slices	Channels	Parallel Test Sites
2	96	36
4	192	16
*8	384	8
*16	768	4

* Not supported in this release version.

Figure 1. Kalos 2 Test System

The workstation computer is PC-based and runs under the Windows XP operating system. The workstation computer is readily networked to a host server using a standard 100/100 Base TX Ethernet. A separate (private) 100 Base TX Ethernet is used to communicate with the 72 ETX controllers in the Kalos 2 test head. The complex system management support requirements imposed on floor operators by a workstation environment are avoided by use of standard Windows based operator interface. A 2.4 GHz cycle rate Intel processor provides computing, and a monitor display offers responsive operator control for viewing test results. See Figure 2.

Figure 2. Tester Set Up



NOTE — Optionally, an additional PC can be added as the data server of Kalos 2 systems.

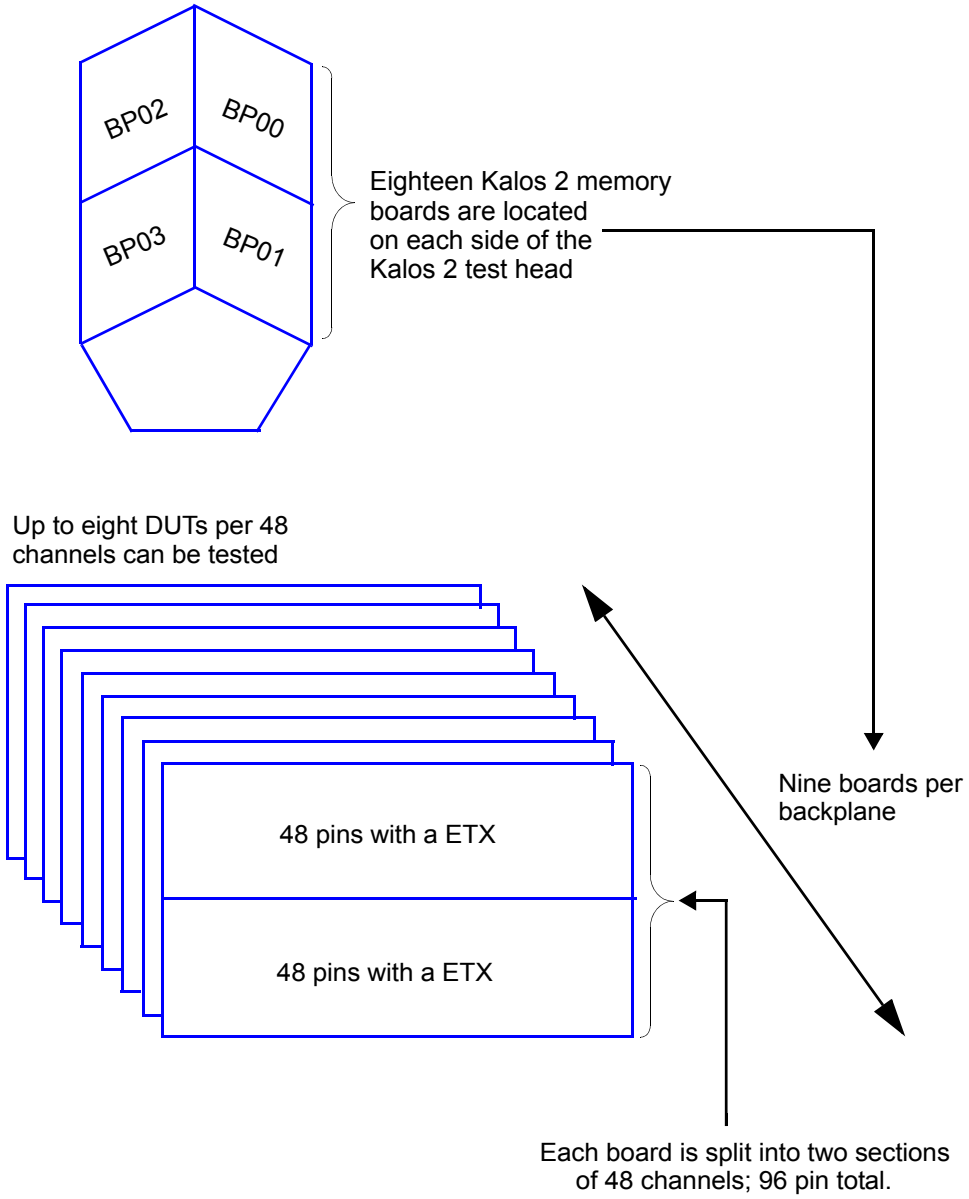
Kalos 2 Test Head

This section describes the Kalos 2 test head. Information on I/O pin configuration, backplane and wiring, test head opening mechanism, cooling, DUT and interface are discussed.

I/O Pin Configuration

The Kalos 2 test head consists of four backplane boards and 36 Kalos 2 96 pin main boards. Each side of the Kalos 2 test head consists of 2 backplane boards and 18 Kalos 2 96 pin main boards. Each backplane board connects to nine 96 pin Kalos 2 main boards. Each of the Kalos 2 96 pin main boards can be broken down into two 48 pin slices (slice 0 and slice 1). Each slice is a 100 MHz test rate, 48 I/O pins, single board tester, and can test up to eight DUTs (see Figure 3).

Figure 3. Test Head Layout


BP02
BP00
BP03
BP01
Eighteen Kalos 2 memory boards are located on each side of the Kalos 2 test head
Up to eight DUTs per 48 channels can be tested
Nine boards per backplane
48 pins with a ETX
48 pins with a ETX
Each board is split into two sections of 48 channels; 96 pin total.

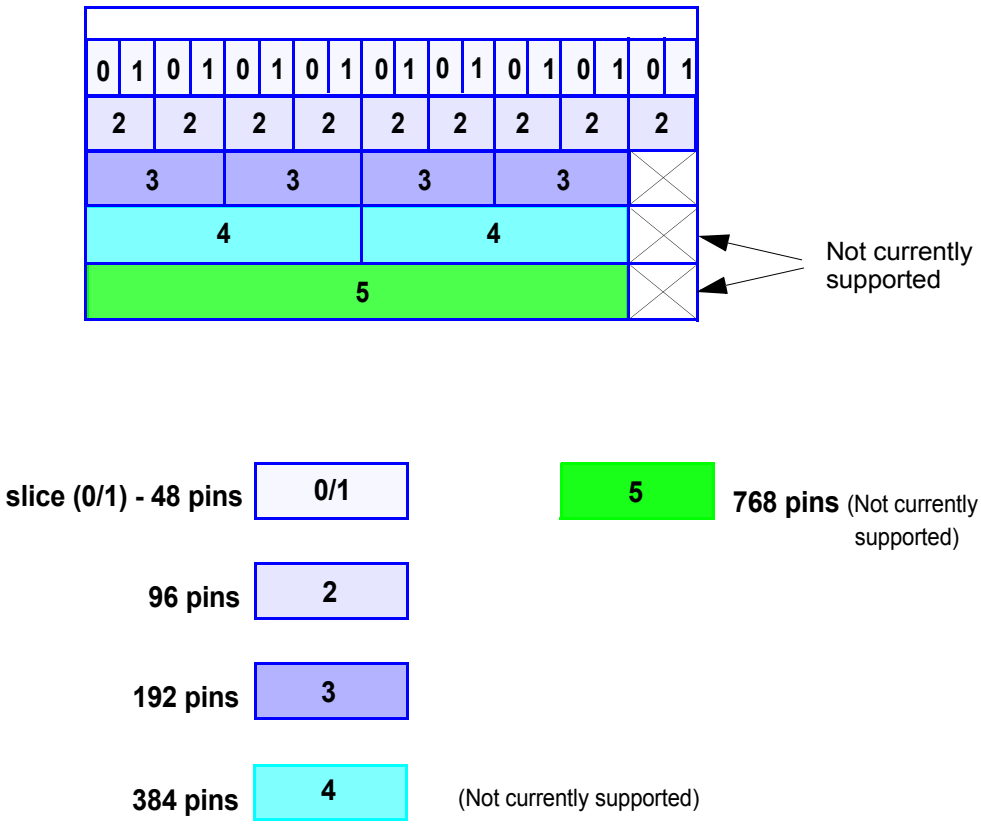
Through Kalos 2 software, the 36 slots of Kalos 2 can be grouped as follows:

One Kalos 2 main board for 96 pins

Two Kalos 2 main boards for 192 pins

The test head pin configuration breaks down further, as shown in Figure 4.

Figure 4. Pin Configuration Breakdown



Backplane and Wiring

The Kalos 2 backplane is shown in Figure 5.

Power and Ethernet Connection

The backplane board contains the DC power, Internal Board Monitor (IBM) link, and Ethernet connections from the server to the Kalos 2 96 pin main boards. Also on the backplane board are two DC to DC power converter modules. One is for the Kalos 2 main board and the other is for the DUT connector. The circuits that control fan speeds, (set of three fans) that control the cage temperature are also located here.

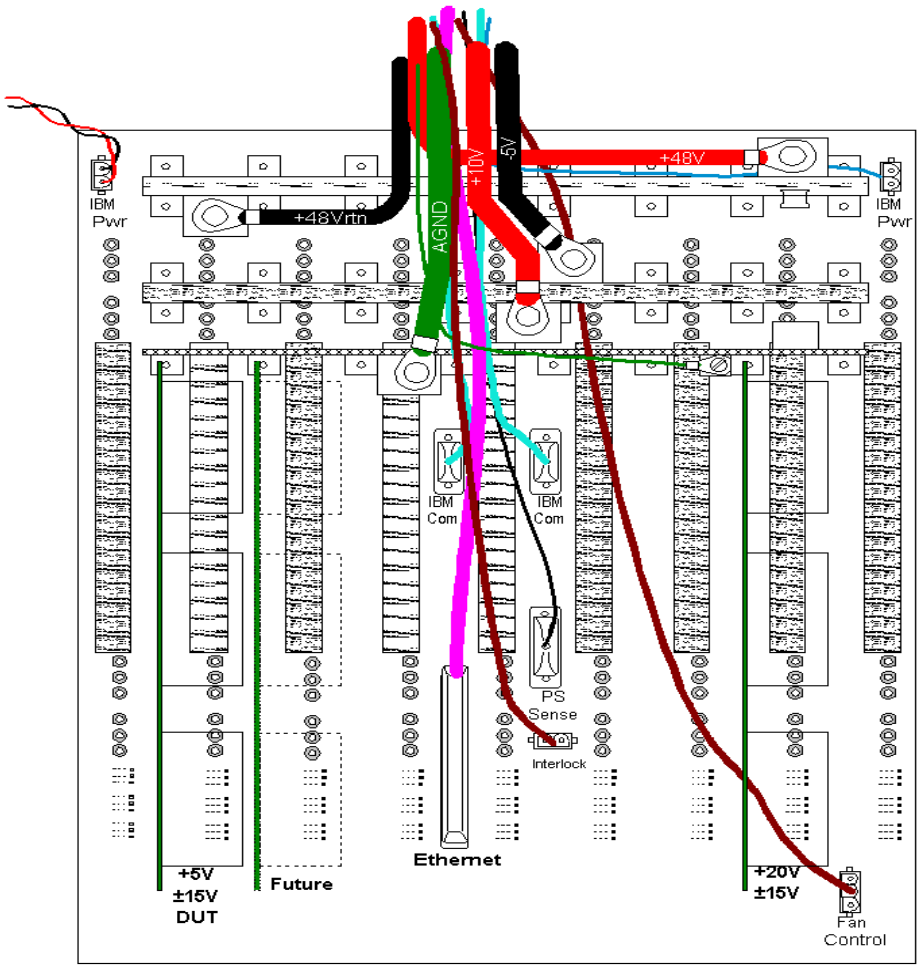
Main Clock

Each backplane contains a 400 MHz crystal as the main clock. This clock is the original clock source for each set of nine Kalos 2 96 pin memory boards connected to each backplane board.

Backplane IDROM

A non-volatile memory (NVM) chip is located on the backplane that contains the electronic information of the backplane, such as part number, ECO level, etc.

Figure 5. Backplane Board



Test Head Opening Mechanism

The test head opening mechanism is pneumatically driven using 80 psi of compressed air. This provides access to one side of the test head. Compressed air is ported to provide the pressure necessary for the pneumatically driven motor to open the test head when the *Power Lock Switch* is pressed.

To close the test head, pull down the test head cover and press the *Power Lock Switch (OFF)*. Compressed air is ported to provide the pressure necessary for the pneumatically driven motor to close the test head. See Figure 6 and Figure 7.

Figure 6. Control Air Schematic

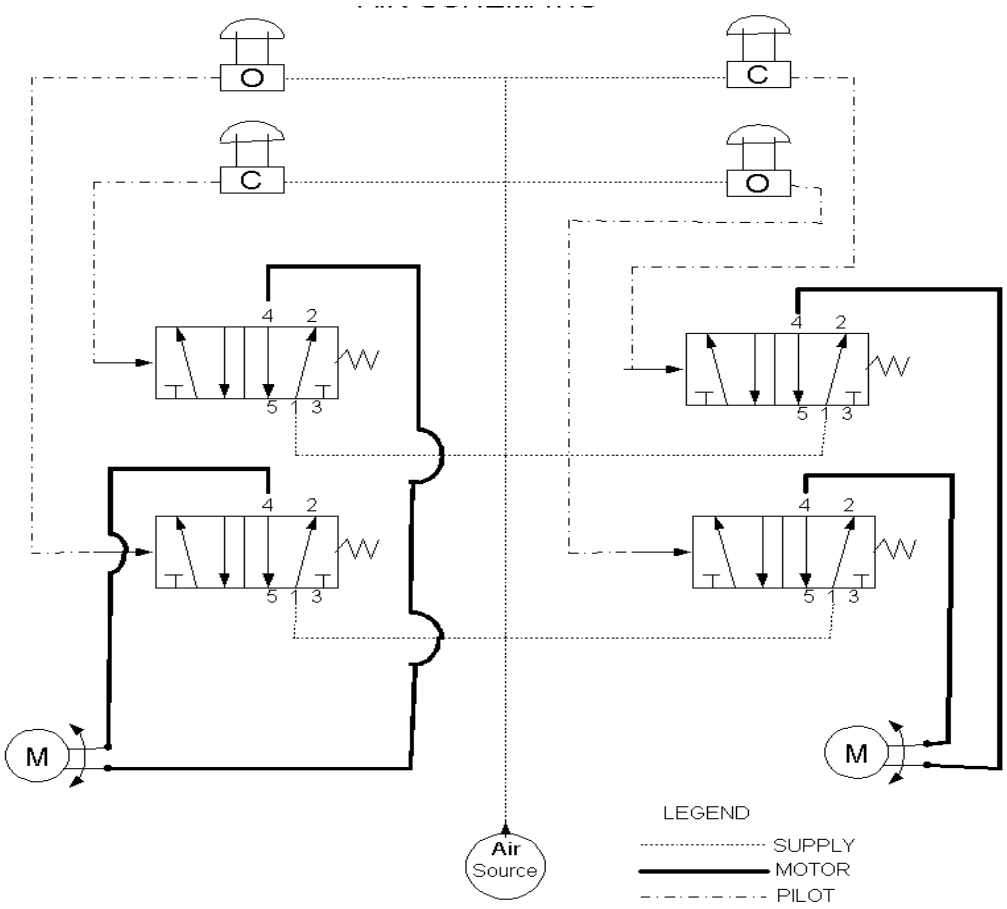
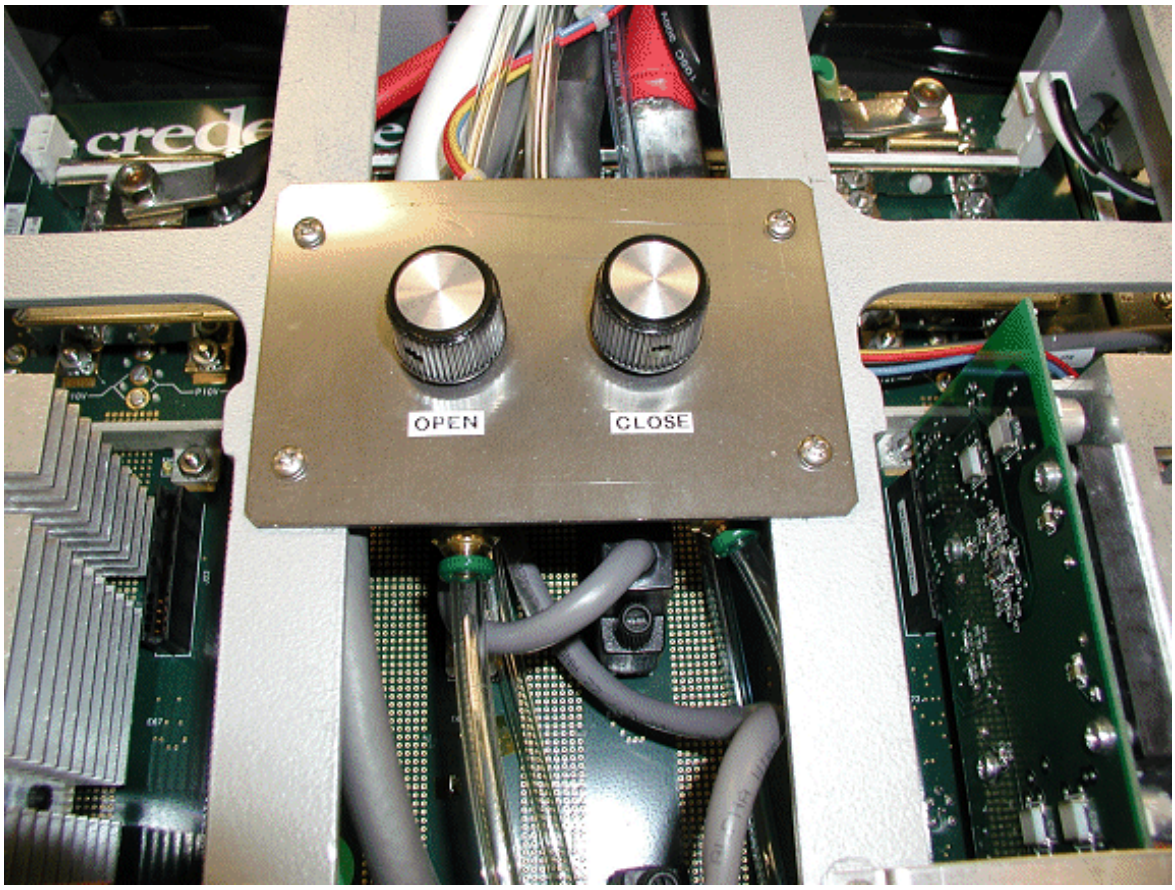


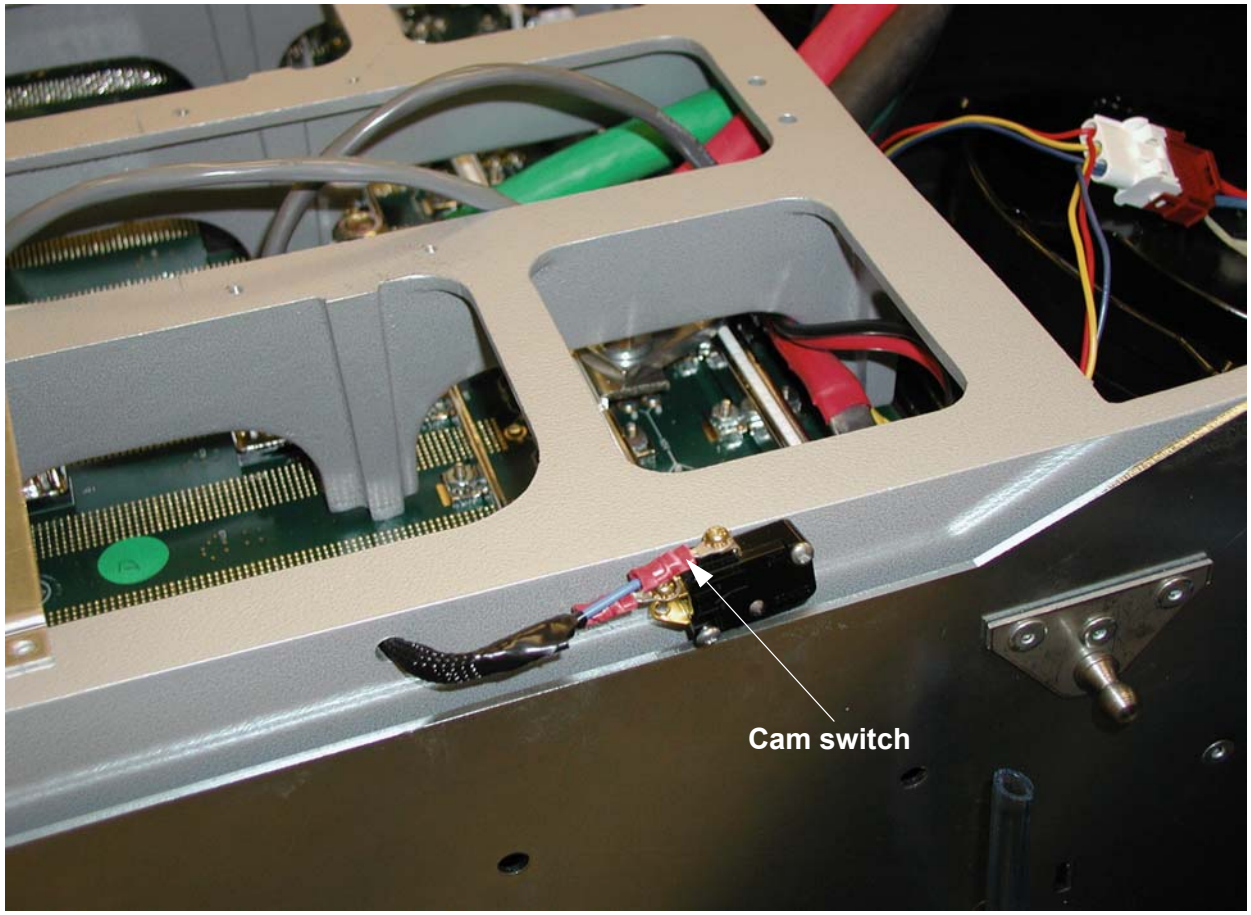
Figure 7. Test Head Opening Mechanism



Test Head Power Shutoff Switch

Each half of the test head has an interlock switch or *cam switch* used to shut down the test head power. These switches are in series with the test head push button located on backplane boards 0 and 3. Two din connectors (DB25) with two pins on the rear of the power rack (located on the server), are used to connect the interlock switches (located on the test head) to the remote enable from the power supplies rack on the server. See Figure 8.

Figure 8. Power Shutoff Switch

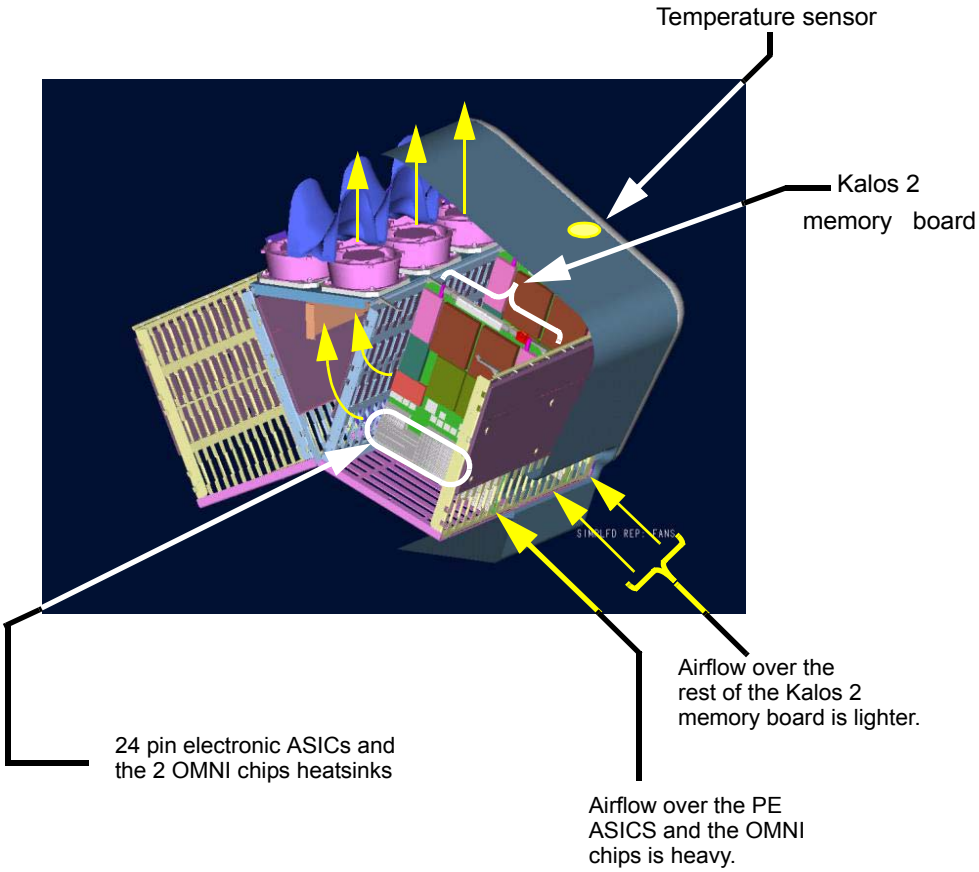


Tester Cooling

Kalos 2 test systems use forced air to cool the test head. The test head comprises six axial fans that are configured into two groups of three fans each (see Figure 9). Two sensors, located on each side of the tester, control the speed of each fan.

The air intake is at the sides of the test head. This forces the air up through the test head, where the Kalos 2 96 pin memory boards are located. The air passes out through the top of the test head where the sensors are located. Once out of the test head, the air is exhausted from the top of the test head out to the ceiling.

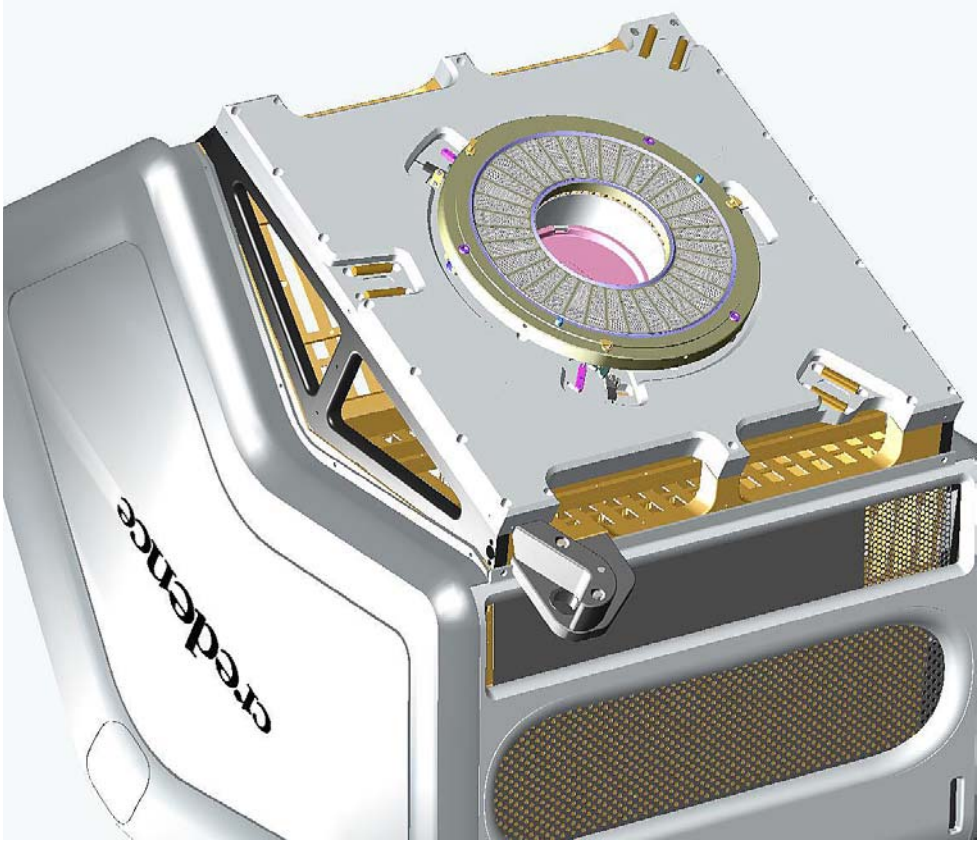
Figure 9. Tester Cooling System



DUT and Interface

Kalos 2 DUT and interface are integrated together. The cable bundle connects the Kalos 2 main board to the interface unit. Kalos 2 interface unit is a pogo tower integrated interface. Therefore, the DUT pin is a pogo pin at the end of the interface. A photo of the interface unit and pin layout is shown in Figure 10.

Figure 10. Interface Unit and Pin Layout



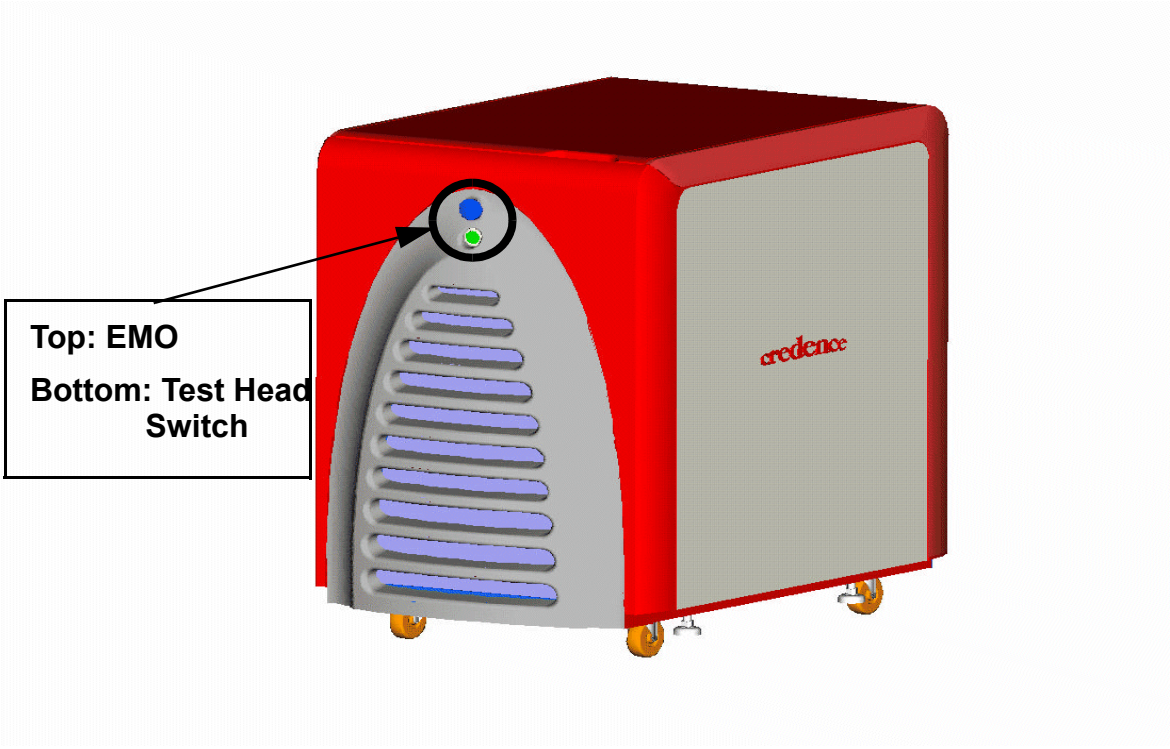
Kalos 2 Server

This section describes the Kalos 2 server. Information on emergency switches, AC control box, and AC configuration are discussed.

EMO and Test Head Switch

Emergency off (EMO) control and test head push buttons are located on the front door of the server, as shown in Figure 11. The EMO button is on the top and the test head power control button is on the bottom. The test head *On* and *Off* button controls all DC power to Kalos 2 test head and boards. The LED's on the test head button illuminate when the switch is on. The EMO switch is used for emergency system shut off. It will trip the main circuit breaker on the AC controller box. An auxiliary voltage for remote control to trip the main circuit breaker uses 24 VAC converted from 220 VAC through a transformer. A safety circuitry guarantees 24 VAC is present, at all times, when the tester is on.

Figure 11. EMO and Test Head On/Off Controls

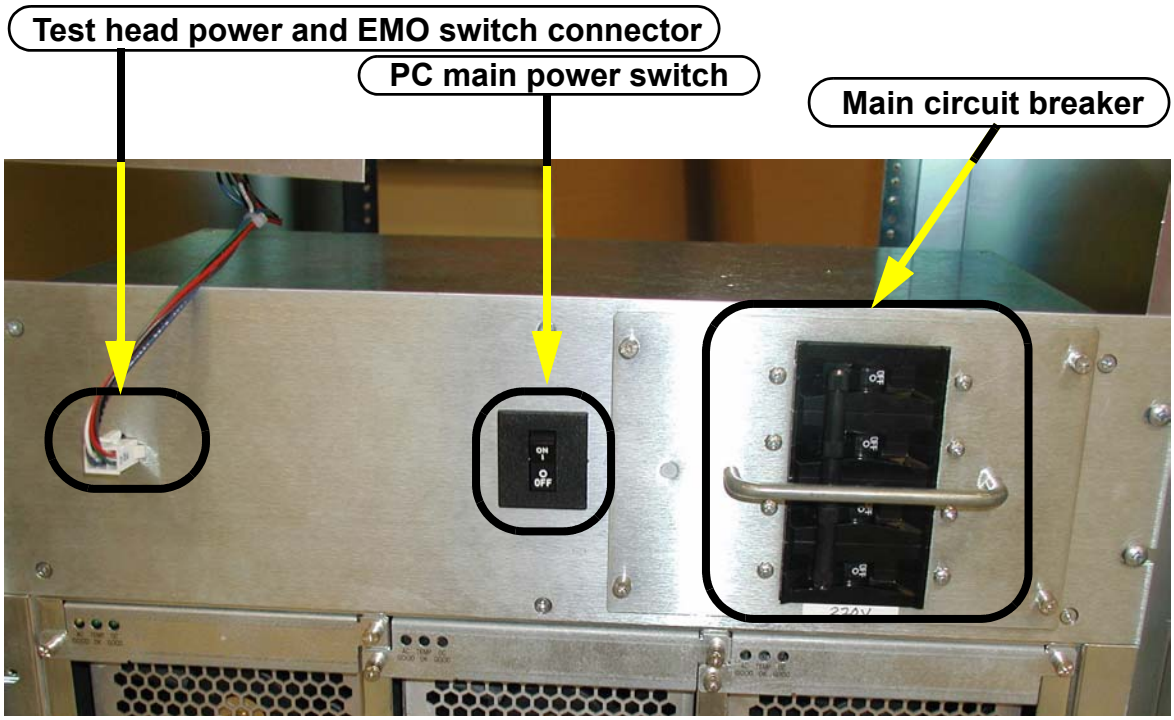


AC Controller Box

The *main* circuit breaker on the AC controller box controls the AC power to the server (see Figure 12). This circuit breaker shuts down the entire Kalos 2 test system, including the server and test head. All power shuts off to the tester due to the activation of EMO or current overload. There is also a switch on the AC controller box for accessories such as computer, monitor, and hubs.

There are eight 220 VAC outlets on the AC controller box. Each uses a 15 Amp common single phase circuit breaker. All accessories such as computer, monitor, and hubs are connected to those outlets. The maximum use for all outlets is limited to 15A.

Figure 12. AC Control Box



AC Configuration

The Kalos 2 input power range is 3 Phase 220 VAC@100 A or 3 Phase 380 VAC@ 60 A (Voltage are +/-10%). A cable for AC input wiring is provided for each Kalos 2 shipped. A 4 wire cable is used for a US version or countries using 3 phase 220 VAC. A 5 wires cable is used for European countries or countries using 3 phase 380 VAC.

Host PC

The host computer, one per system, is a 2.4 GHz Intel Xeon processor, Pentium 4 based PC and runs under the Windows XP Professional operating system (see Figure 13). It uses a high-resolution monitor (1600x1200) with a CD-RW drive (48x/24x/48x). It also loads with Kalos 2 software for testing. The host PC is readily networkable to a local networking link using a standard 100 Base TX Ethernet port (to and from the test head) that is used to communicate with the 72 ETX controllers in the Kalos 2 test head. An external 10 BaseT/100 Base TX Ethernet port is used by the host PC to ensure that the Kalos 2 test system is readily networkable to a local networking link. The host PC has a 36 GB Ultra 320 SCSI hard drive. The serial, parallel, and USB ports of the PC link to the backplane for Internal Board Monitor (IBM) communication. A GPIB external port is also included for communication between the Kalos 2 system and a prober or handler. An optional second PC can be added as the data server of Kalos 2 systems.

Figure 13. Host Computer

Main Board

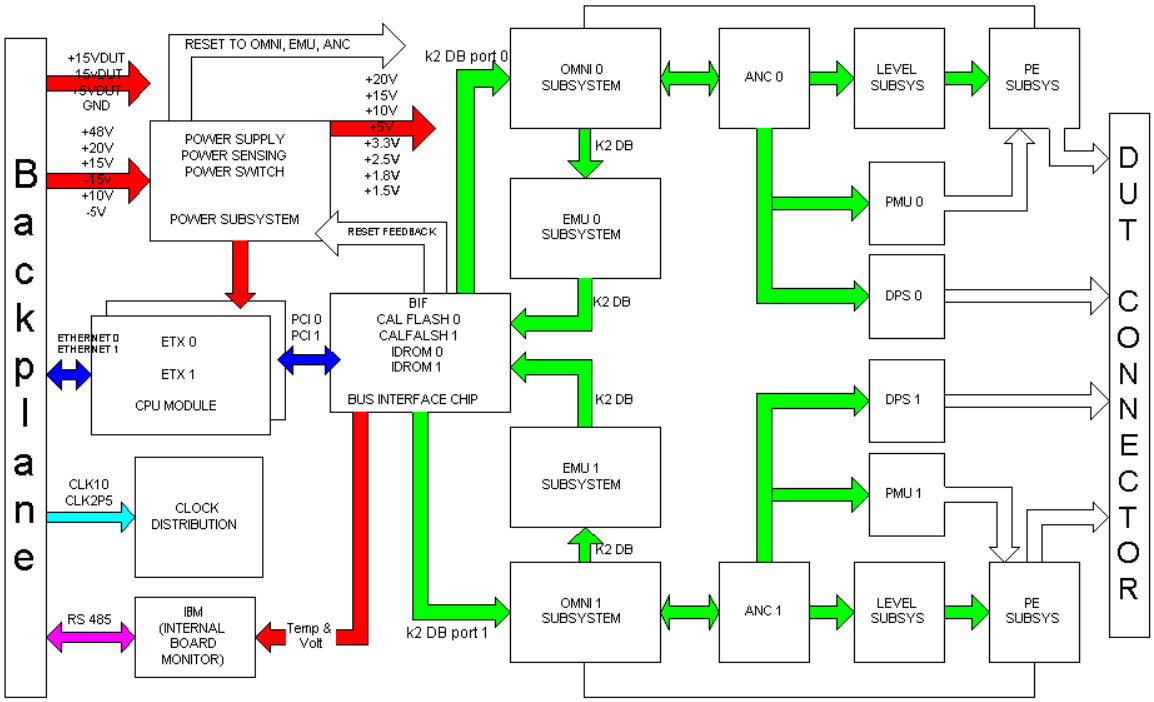
The Kalos 2, main board; hardware configuration and ETX modules are described in this section.

Hardware Configuration

The Kalos 2 board consists of the main board as well as the following modules (see Figure 14):

- 2 ETX's (CPU Modules)
- 2 PMU Modules
- 2 DPS Modules
- 2 EMU Modules

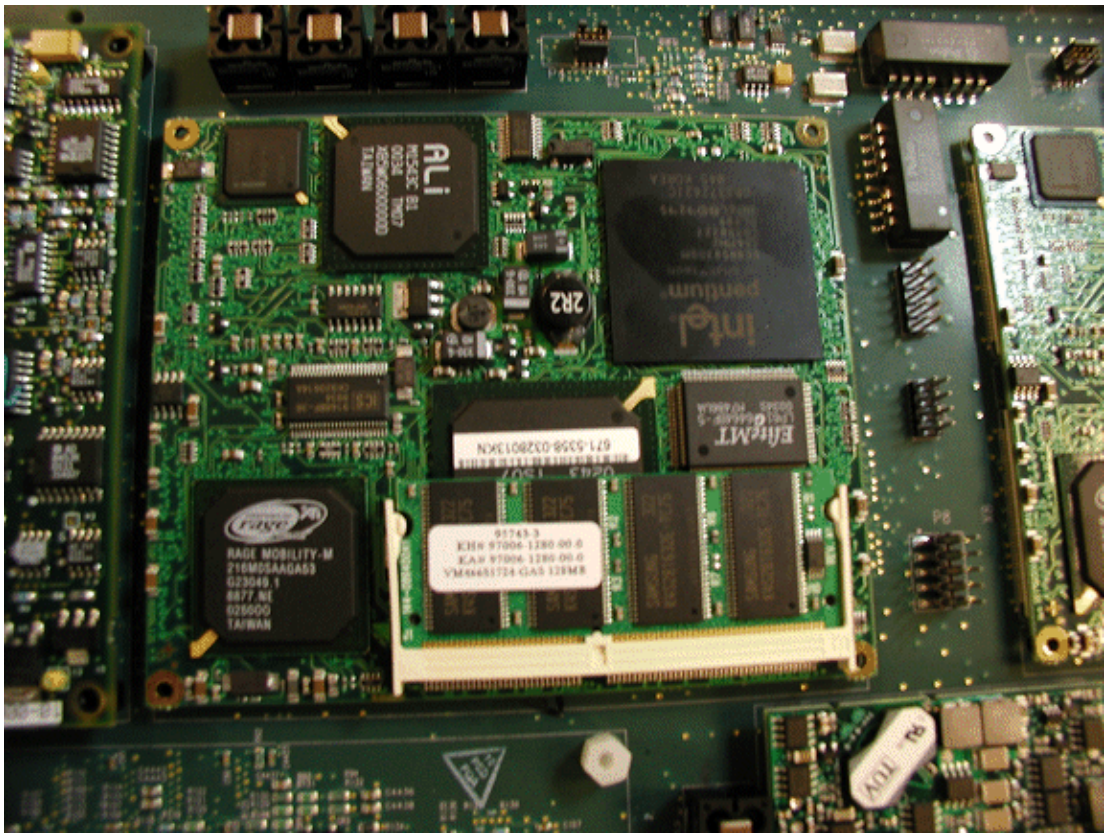
Figure 14. Hardware Configuration



ETX (CPU Module)

The ETX module is used for data transactions. The Ethernet inputs data into the ETX, the ETX converts this to a PCI signal, outputting it to the BIF by way of the ANC and Omni subsystem (see Figure 15).

Figure 15. ETX Module



There is one ETX or CPU module per slice. It has a PI-266 MHz ETX Intel mobile Pentium (X86) based controller with 128 Megabytes of DRAM. It uses the WindRiver VxWorks AE ROTS (real time operating system). The ETX has Broadcast capability to write per-pin resources or central resources across more than one slice and the ability to control from one to sixteen slices. The ETX uses 100 Base TX Ethernet connections to the host computer.

2

USER OPERATIONS

This chapter describes the operating environment, and provides information on the following user operations:

- Basic System Operation
- Logging On / Off and Shutdown
- Working With Files and Folders in Windows XP

Operating Environment

The Kalos Integrated Test Environment (KITE) software operates on the Kalos 2 workstation computer, an Intel® Pentium® processor-based system. The user interface is implemented using the Microsoft® Windows XP® operating system.

The KITE software provides access to development, debug, and diagnostic tools and utilities through a graphical user interface.

For the purposes of this manual, it is assumed that the user is familiar with the Microsoft Windows operating environment, including its commands and system file structures. The following section contains a short description of the Windows XP interface controls that are referred to in this documentation.

Networking

Kalos 2 operates stand-alone or connected to other computer systems on a network that support Ethernet and TCP/IP protocol. The network provides a flexible test environment, allowing program development and the tester data base to be hosted on different computers within the network.

PC Requirements

Following are personal computer requirements necessary to run Kalos 2 test systems.

- Windows XP Professional
- 16-bit small font
- 1280 x 1024 minimum monitor settings
- 1600 x 1200 for special Bitmap (Mega Map)

Table 2. Network Protocols

Feature	Characteristics
Network protocol	TCP/IP
Network software	Windows XP Professional

Basic System Operation

Following is a definition of terms.

Home Directory	Directory in which the user is placed upon login. This is also where user “start up” files are located.
Working Directory	The current location, of the user, within the hierarchical directory structure. Use the **dir** command to print working directory.
Parent Directory	This is the directory one level directly above the current directory.
Child Directory	This is the directory one level directly below the current directory.
\ (back slash)	Symbol used to separate directory levels.

Logging Into the System

In order to log into a system or workstation, a user account is needed.

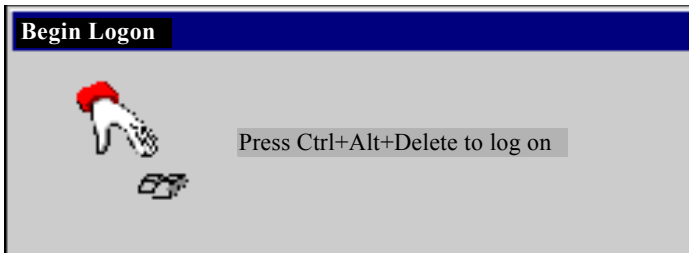
User account requirements:

- A user ID (login name)
- A password (usually user selected)

Once a user account is acquired, login information, including user ID and password is entered at the login prompt in Windows XP, as follows:

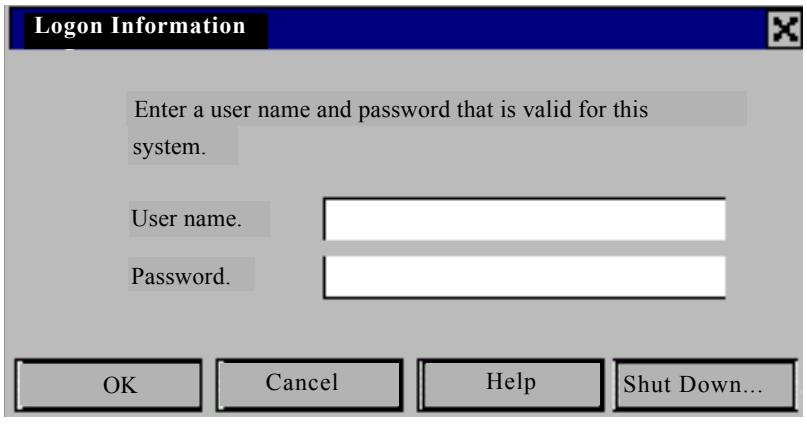
The system workstation automatically boots on power up. Once booted, a message appears on the screen prompting the user to press ‘Ctrl + Alt + Delete’ to log on (see Figure 16).

Figure 16. Logging On



Pressing the Ctrl + Alt + Delete keys simultaneously, invokes the Logon Information window which asks for a user name and password (see Figure 17). Note that user name and password are case sensitive.

Figure 17. Logon Information



User Password

When you first acquire a user account, a standard password should be assigned to your account. This helps to maintain the integrity of your programs and data. The assigned Windows XP system administrator should have tools for managing user accounts. Before changing your account password, contact the system administrator for any additional instructions or requirements.

The system prompts you to enter your old password for confirmation before allowing you to change passwords. Enter your current password and press the Return key.

The system now prompts you to enter your new password. Again, password characters are not displayed on screen. Enter the new password and press the Return key. The system prompts you to enter your new password again to confirm what you entered is correct.

The system informs you that your password is changed.

NOTE —

- Password character lengths are determined by the system administrator. A warning message is displayed if the password is not long enough.
- Upon your next login, remember that you have changed your password.

Upon logging into the system, the user desktop display shows the resources that are accessible. These resources are set up by the system administrator.

NOTE — The system does not display password characters on screen. This is for security purposes.

Once logged in, the Windows XP desktop appears (see Figure 18).

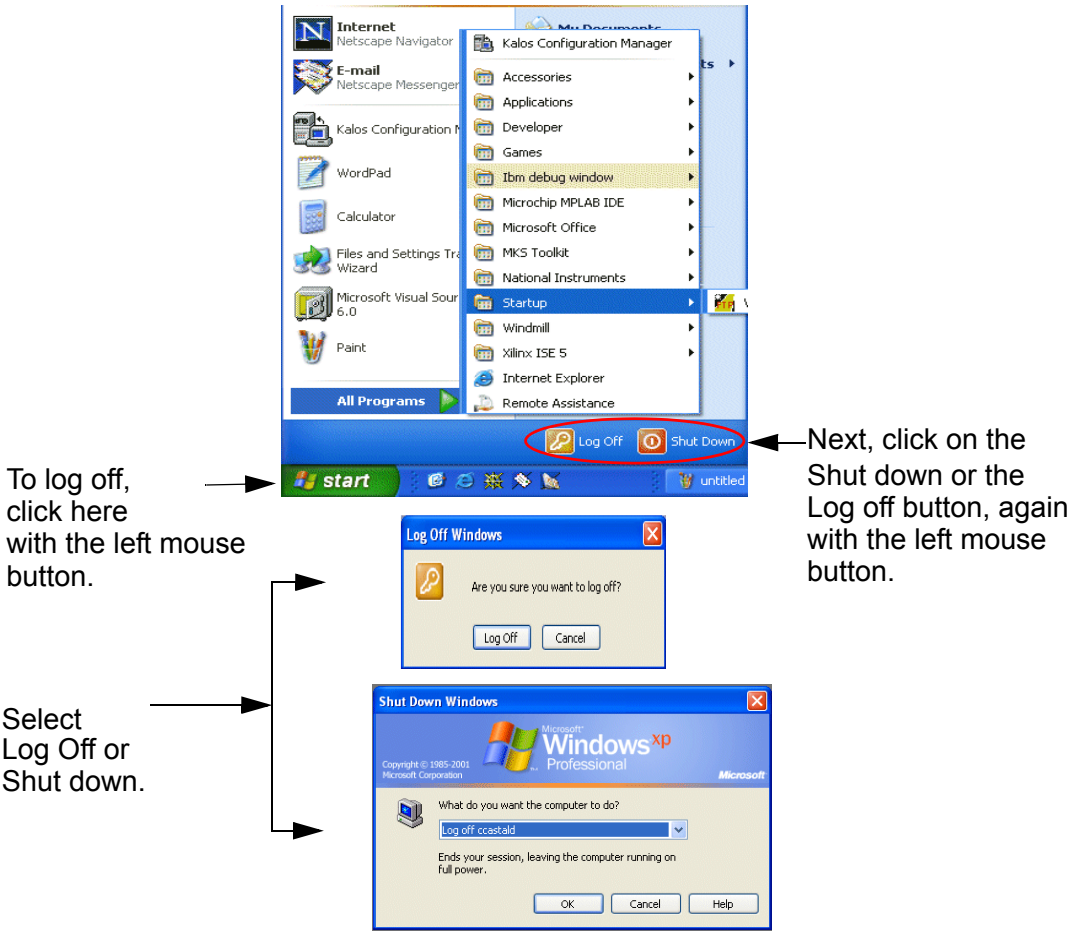
Figure 18. Windows XP Desktop

Logging Off and Shutdown

When you have completed work on the computer, you should log off the system.

Log off of the system by pressing CTRL-ALT-DELETE keys to get the Windows XP Security window, or by selecting *Log off* or *Shut down* from the Start menu (See Figure 19). Log off is used to log off your account, without turning off the workstations power. Shut down is used to power down the workstation.

Figure 19. Log Off and Shut Down



The system completes any necessary cleanup and logs you out of the system. This process is complete when the Login dialog box appears or the screen saver becomes active.

Software Architecture

The KITE software operates on the Kalos 2 workstation computer, an Intel® Pentium® processor-based system. The user interface is implemented using the Microsoft® Windows XP® operating system. For the purposes of this manual, it is assumed that the user is familiar with the Microsoft Windows operating environment, including its commands and system file structures. The following section contains a short description of the Windows interface controls that are referred to in this documentation.

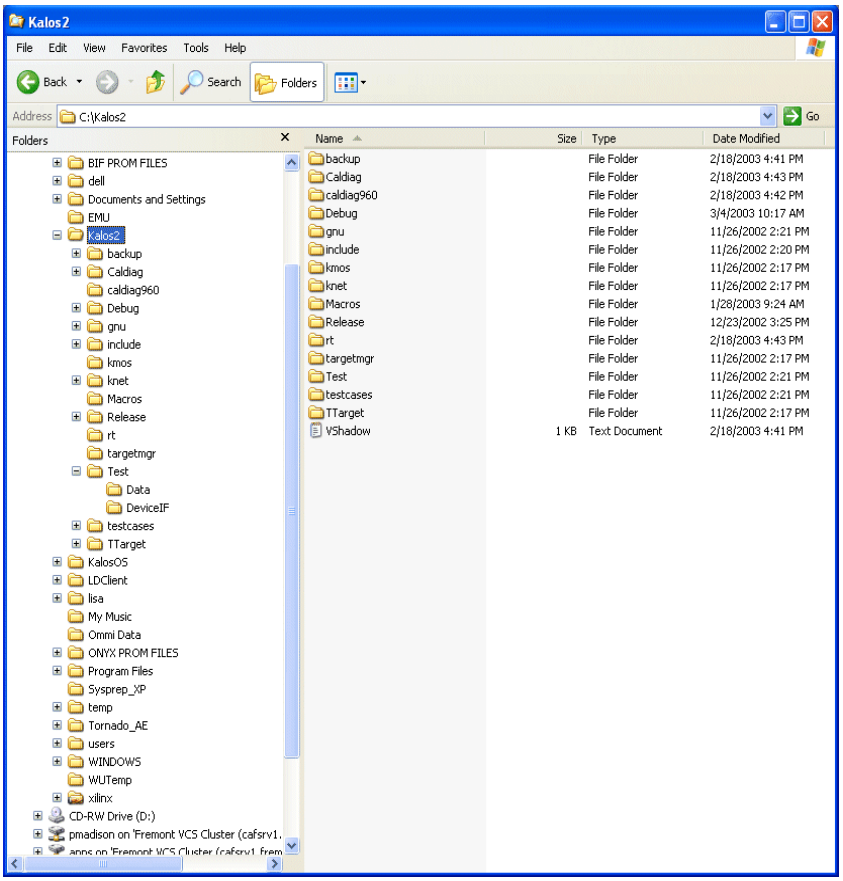
File Structure

There are two directories that contain files and data necessary to operate the Kalos software (KITE). The two primary subdirectories are: C:\Kalos and C:\KalosOS. These files are located on the C drive.

C:\Kalos Directory

The C:\Kalos directory contains subdirectories that include files and data that have traditional locations that users must be aware of. The primary subdirectory is the *bin* subdirectory. The bin directory contains the executables, as well as all the calibration and diagnostic routines that are run on Kalos 2 test systems. By default, files are saved to this subdirectory location unless otherwise specified (i.e., summary files of a calibration run). The *doc* subdirectory located off of the Kalos directory contains .pdf files which contain the documents used in the help files as well as the user applications changes, etc. The *Kalos/Test/ DeviceIF* subdirectory contains the driver files as well as the production.ini files. The production .ini files contain the settings for prober drivers. The *Data_Engine* and custom GUIs are currently applications supported hardware. This directory structure is shown in Figure 20.

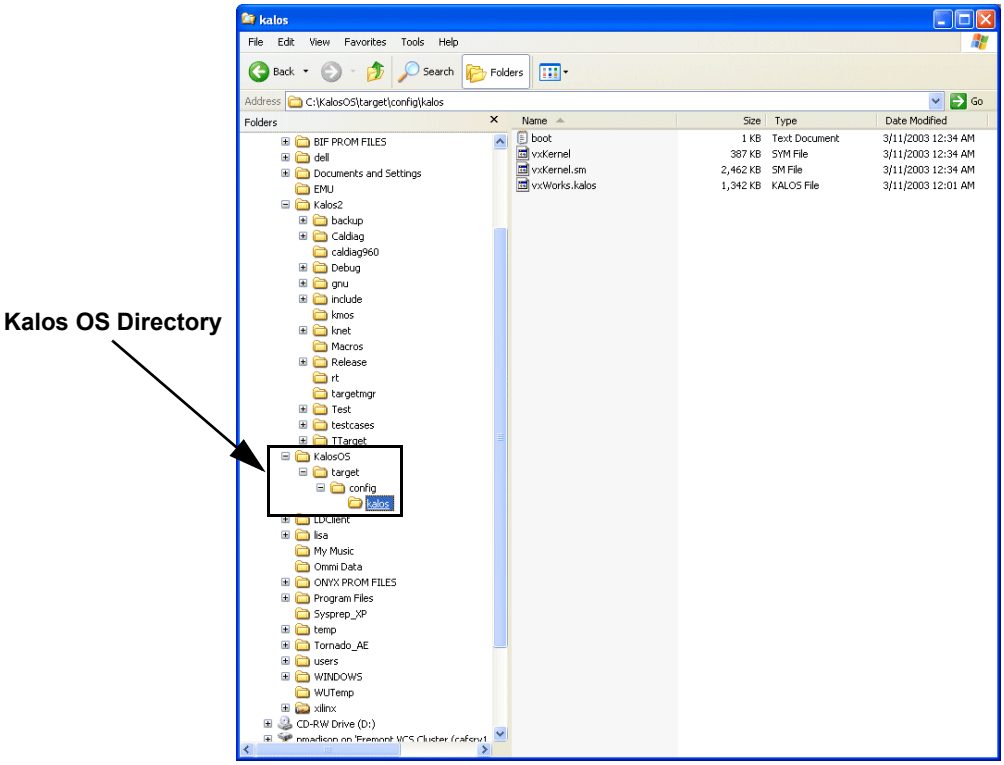
Figure 20. Kalos2 Directory



C:\KalosOS Directory

The Kalos.OS subdirectory contains the vxworks files which direct the TTarget to load the correct version of software. This directory structure is shown in Figure 21.

Figure 21. KalosOS Directory



Windows XP® Interface Controls

The Windows XP graphical user interface contains standard controls and display areas which are part of the interface for any application which runs under Windows XP. Their functions are explained in this section.

The Windows XP Graphical User Interface (GUI) provides the standard controls and displays of KITE. This section is not intended to provide a full description of the Windows XP operating system, but rather to explain the standard controls and interactions as they pertain to the KITE interface. Each is discussed in the following subsections.

Start Menu

The Start button, used to quickly start a program or find a file, is located on the taskbar at the bottom of the screen (see Figure 22).

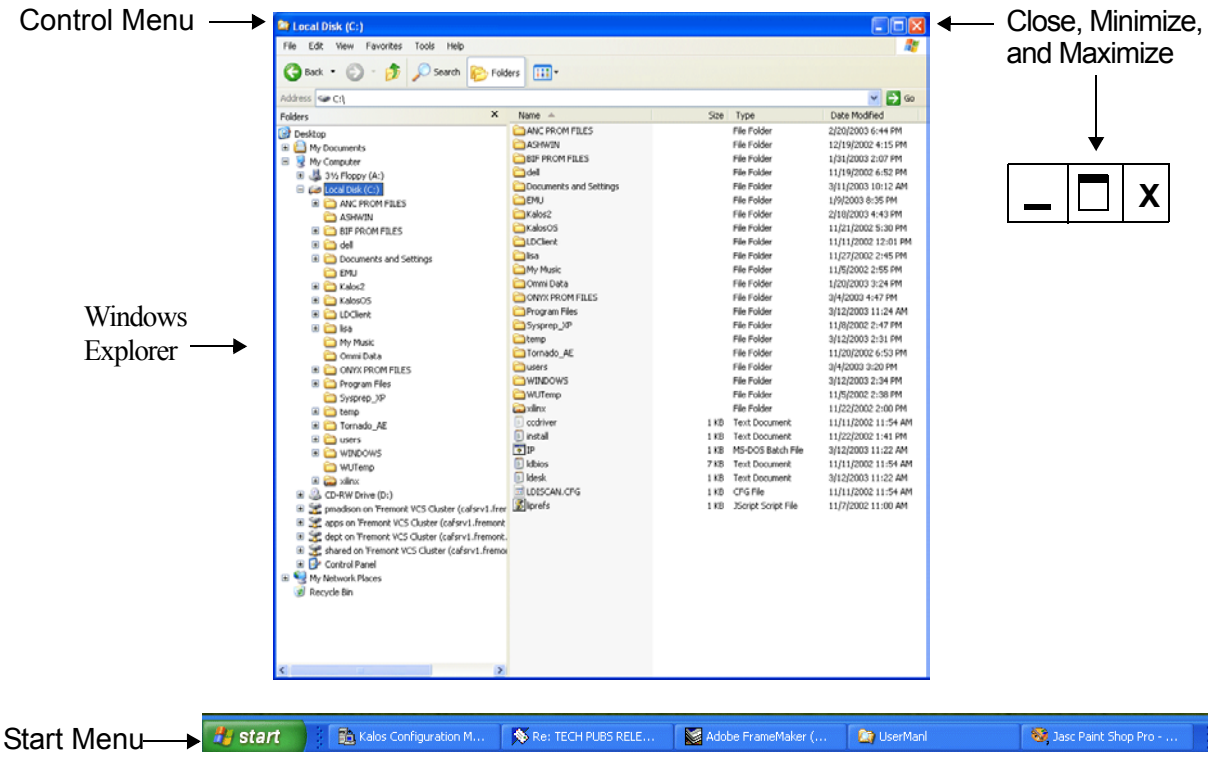
When a program, document, or window is opened, a button identifying it appears on the taskbar. This button can be used to quickly switch between the windows that are open.

Windows Explorer

In Windows Explorer, the hierarchy of folders on the computer and all files and folders within each selected folder can be seen. This is especially useful for copying and moving files. You can open the folder that contains the file you want to move or copy, then select and drag it to the folder or location you want to put it in.

To find Windows Explorer, right-click the Start button, then point and click on Programs --> Accessories--> Windows Explore (see Figure 22).

Figure 22. Windows XP Start Menu and Explorer



Control Menu

The control menu is opened by selecting (left mouse) the control menu box in the upper-left corner of the application window, on the title bar for the application or file (see Figure 22). When an application is minimized, this menu can be accessed by right-clicking on the application icon in the Window's Start menu bar.

The control menu box provides a drop down menu containing the following options.

Restore

The Restore option returns the application window to its former size after the window is enlarged (maximized) or reduced (minimized).

Move

This option allows the application window to be moved to another position by using the keyboard.

Size

This allows the application window to be resized using the keyboard.

Minimize

Minimize reduces the application to an icon on the Start menu bar.

Maximize

The Maximize control switches the size of the window between its former and maximum size. When the window is not in its maximum size, the height and width of its borders can be changed by clicking on the outside edge of the window, until the cursor changes to a two-sided arrow, and dragging it to the desired dimensions.

Close

For an application, the Close command is used to quit the application and close any of its opened files.

For an opened file, the Close command closes only the file for which the control was chosen.

Close, Minimize, and Maximize Buttons

Every window has an **x** (close button) in the upper-right corner that can be clicked to close the window and quit the program.

The minimize and maximize buttons are positioned next to the close button.

Title Bar

The title bar spans the top of the application window and displays the application name. When a file is opened within an application, there may also be a title bar across the top of the file which contains the path and file name. Any window can be moved by clicking on the title bar and dragging the window to a new location.

Status Bar

The Status Bar is a single message line that can be seen at the bottom of any Windows XP application window. It acts as an interface to the user from the tester to communicate the operations of the associated application. If the Status Bar is not present, choose View => Status Bar from the pulldown menu at the top of the application window to display it.

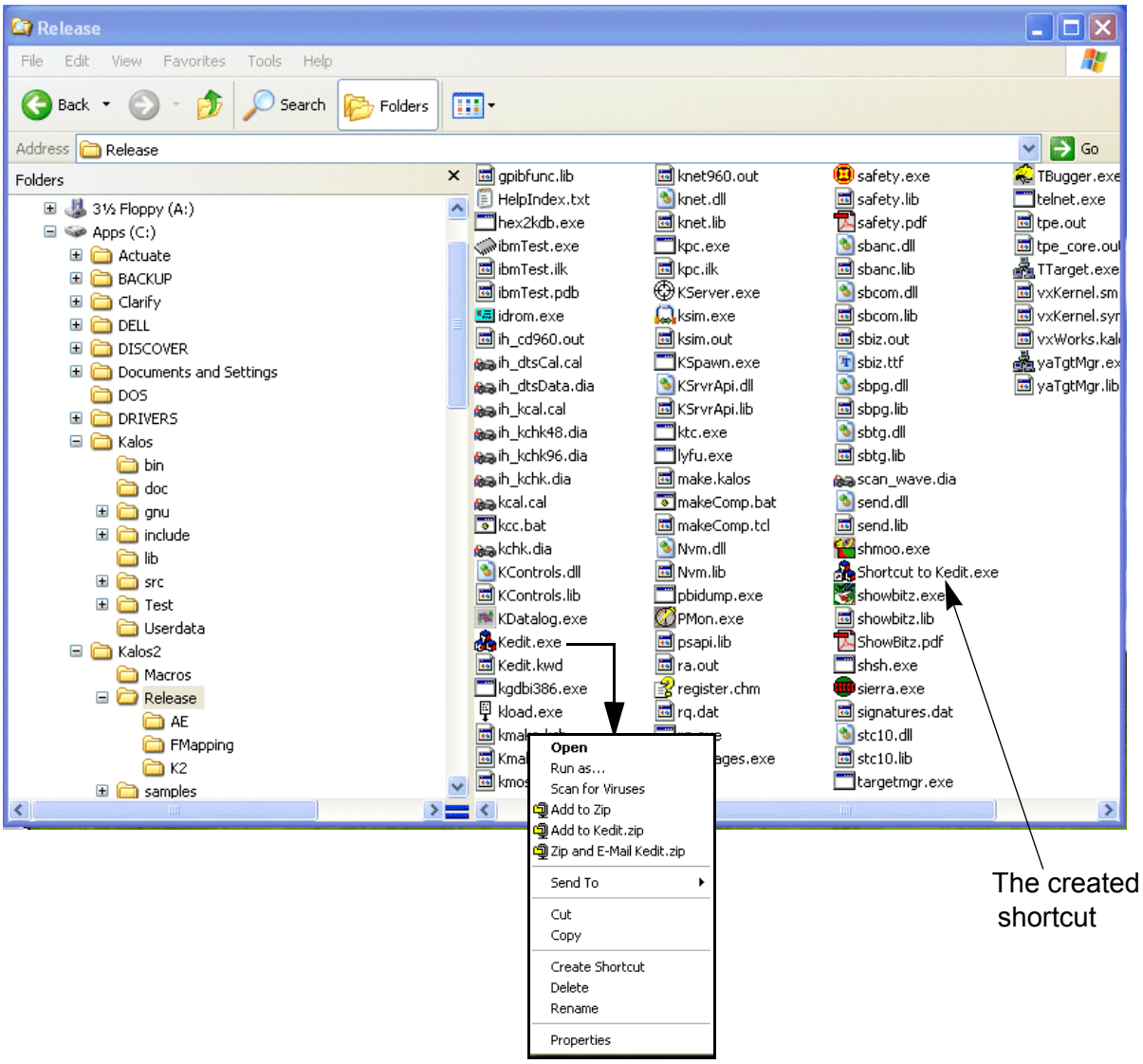
Shortcuts

Shortcuts allow the user to directly launch a specific application without using the Start menu button.

Creating Shortcuts

To create a shortcut, go to the Start menu and launch Windows Explorer. Next, select the desired file or application and click on the right mouse button. A pulldown menu appears (see Figure 23). Choose “Create Shortcut.” In the directory where the file or application is located, a Shortcut file is created.

Figure 23. Creating Shortcuts



Using Shortcuts

Once the shortcut is created, click and hold the shortcut icon using the right mouse button. While holding down the right mouse button, drag the icon to the background area where you want it to reside. To launch the application or file, double click the left mouse button on the shortcut icon.

Launching Applications

There are two ways to launch an application when using Windows XP. You can open the application by double clicking on the application in Windows Explorer, using the right mouse button, or you can double click on a shortcuts icon using the left mouse button.

If you choose to launch a file using a shortcut icon, the application in which the file was created is also launched. For example, if the chosen file is a FrameMaker file, FrameMaker launches, then the selected file opens.

Launching KITE

The launching of KITE software is part of the start-up procedure for the Kalos 2 test system. The user must invoke the KITE software in order to launch the Front Panel application. The default condition of the KITE application is the production environment from which Kalos test programs are loaded and executed. From Front Panel, all other applications, tools, and utilities can be launched. The menu bar and toolbar provide the mechanism for executing these other applications.

Working with Files and Folders in Windows® XP

This section describes some of the basic methods used to create, name, move, copy, and delete files and folders using the Windows XP environment.

Creating Folders

New folders are created in the current directory. Before creating a new folder, ensure that you are in the directory in which you want the folder to reside. To create a new folder:

1. Launch the Explorer application.
2. Left mouse click on the File button and drag the cursor down to New.
3. While still depressing the mouse button, drag the cursor to the right and select Folder.

A “New Folder” appears in the current directory.

Naming Folders and Files

Name a New Folder or rename an existing folder by slowly double clicking the left mouse button on New Folder or on an existing folder name. Type in the new name or change the existing name. File names can be changed in the same manner.

Moving Folders and Files

While in the Explorer application, move a folder or file by left mouse clicking on the image to the left of the folder or file and while still depressing the left mouse button, drag it to the new location. If the folder or file is to be placed inside of an existing folder, drag the folder/file to that location (the folder will highlight) and release the mouse button.

Copying Folders and Files

While in the Explorer application, copy a folder by right mouse clicking on the folder you want to copy. A pop-up menu appears. Left mouse click on Copy. Open the directory in which the copied folder is to be placed. Using the left mouse button, go to Edit => Paste in the pulldown menu and release.

Copy a file by right mouse clicking on the file you want to copy. A pop-up menu appears. Left mouse click on Copy. Open the directory in which the copied file is to be placed. If the file is to be placed in an existing folder, select the folder and using the left mouse button, go to Edit => Paste in the pulldown menu and release.

Deleting Folders and Files

While in the Explorer application, delete a folder or file by right mouse clicking on the folder or file you want to delete. A pop-up menu appears. Left mouse click on Delete. A pop-up menu appears to verify the execution of this command.

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3

TEST PROGRAM DEFINITION

This chapter provides a definition of the Kalos Test Language (KTL) and Kalos Pattern Language (KPL), and an overview of the procedures involved in developing a test program file for the Kalos 2 memory tester. Instructions for using the Kedit utility, a Kalos supplied text editor used to generate, edit, compile and debug test programs, are also provided. Topics include:

- Test Program Language
  - C Source File (CMODULE)
- Test Program File
  - Program File Layout
  - Socket Table
  - Pingroups
  - DC Tests Parametric
  - Functional Test
  - Bin Table
  - Flow Statement
  - Program Files
- Kedit
  - Program Loading
- Navigation and Edit Tools
- Debugging Using Kedit
- Debugging KPL Source Code in Kedit

IMPORTANT — Version Compatibility - Recompile Test Programs

Per the Kalos software release policy, all test programs must be recompiled when upgrading to a major release. In order to use the 1.11 version of software, all test programs must be compiled with the 1.11 compiler.

Test Program Language

This section provides the definitions for the Kalos Test Language (KTL) and Kalos Pattern Language (KPL). Also provided is an overview of the procedures involved in developing a test program file for the Kalos 2 memory tester.

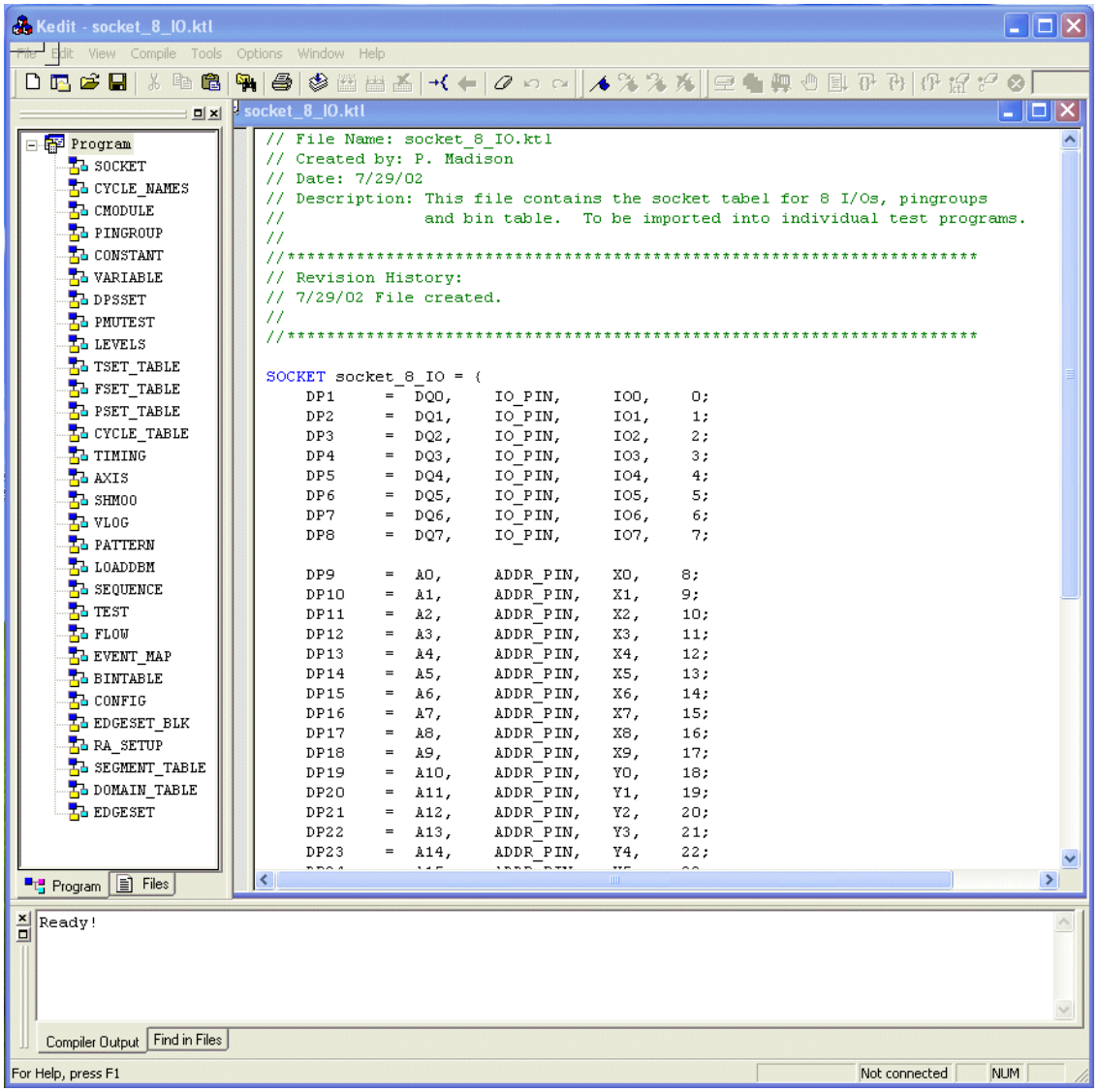
Kalos Test Language (KTL)

Kalos 2 test programs are written in the Kalos Test Language (KTL). This intuitive test language, designed specifically for the needs of Kalos 2 memory testers, is based on the ANSI-C programming language. There is no procedural code-test flow, and test sequences are encapsulated into data structures. The compiled binary formatted executable version of the KTL file includes a .kbi (Kalos binary interface) extension. KTL files are created using one of the following two methods:

- Any ASCII text editor
- Kedit (A Credence supplied text editor)

Figure 24 shows a typical KTL program file. The programs that are listed on the left are optional parts that can be used in a test program run. The main window shows the program header information. Header information may list program information such as the device type, description, origin, application dates, etc. Header lists are not required, but they provide a history of the test program.

Figure 24. KTL File



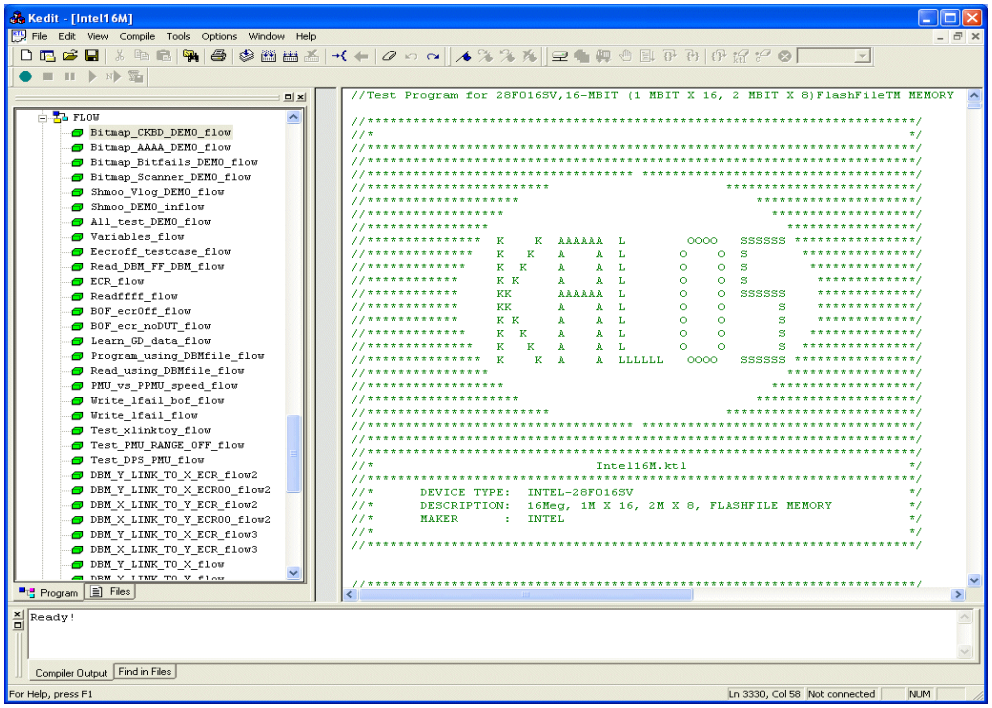
Kalos Pattern Language (KPL)

The Kalos Pattern Language (KPL) enables the creation of test patterns in ASCII text format. These patterns are then transformed by the Kalos Pattern Compiler (KPC) into binary images which are loaded into the pattern generator(s) prior to the execution of a test. The compiled binary version of the KPL file includes a .pbi (pattern binary interface) extension. Labels.h file(s) are also created by the pattern compiler to map labels to micro-instruction locations. The KPL is a block structured language that comprises elements shared with the test program. Some elements are optional, and some may appear more than once in a pattern file.

C Source File (CMODULE)

C functions can be used inside of a test sequence in a KTL program as long as they are first declared inside a CMODULE statement. When used in a Kalos 2 test program, C functions are referred to as C-Hooks. The C source file defines the C function(s). The compiled binary CMODULE(s) are given a .o (C-Hook object file) and a .h (C-Hook header file) extension. See Figure 25.

Figure 25. KTL Program



Kalos 2 Files:

Before Compilation	After Compilation
.ktl	.kbi
.kpl	.pbi
	Labels.h
.c	.o
	.cmodule.h

NOTE — File extensions may change in future revisions of software.

Test Program File

The KTL test program file contains the overall procedure for testing a device. It includes functions for setting up the tester, stimulating the device, and checking the responses of the device.

The contents of a KTL test program file look similar to the contents of a simplified C language file. The KTL file may begin with a header that contains directives common to the functions that follow. It may also contain directives at different points throughout the program. The body of the program contains several test program operations, or data objects. Each is defined in a statement block that is specific to its function.

There are five types of directives which are supported in the KTL. They are:

#include	Points to a KTL program file.
#clibrary	Allows you to load compiled C object files to be included with your test program and can also load C-Hooks from a directory other than where the test program is loaded from.
#define	Labels that are replaced by user defined text when the program is loaded or a text string is replaced.
#ifdef	Conditionally compile the block of lines through terminating #endif.
#endif	Terminates corresponding block of lines that began with #ifdef).
#pragma	Invokes special features

The test program is a collection of data and sometimes includes compiled user code. Conceptually the data is organized into the following parts:

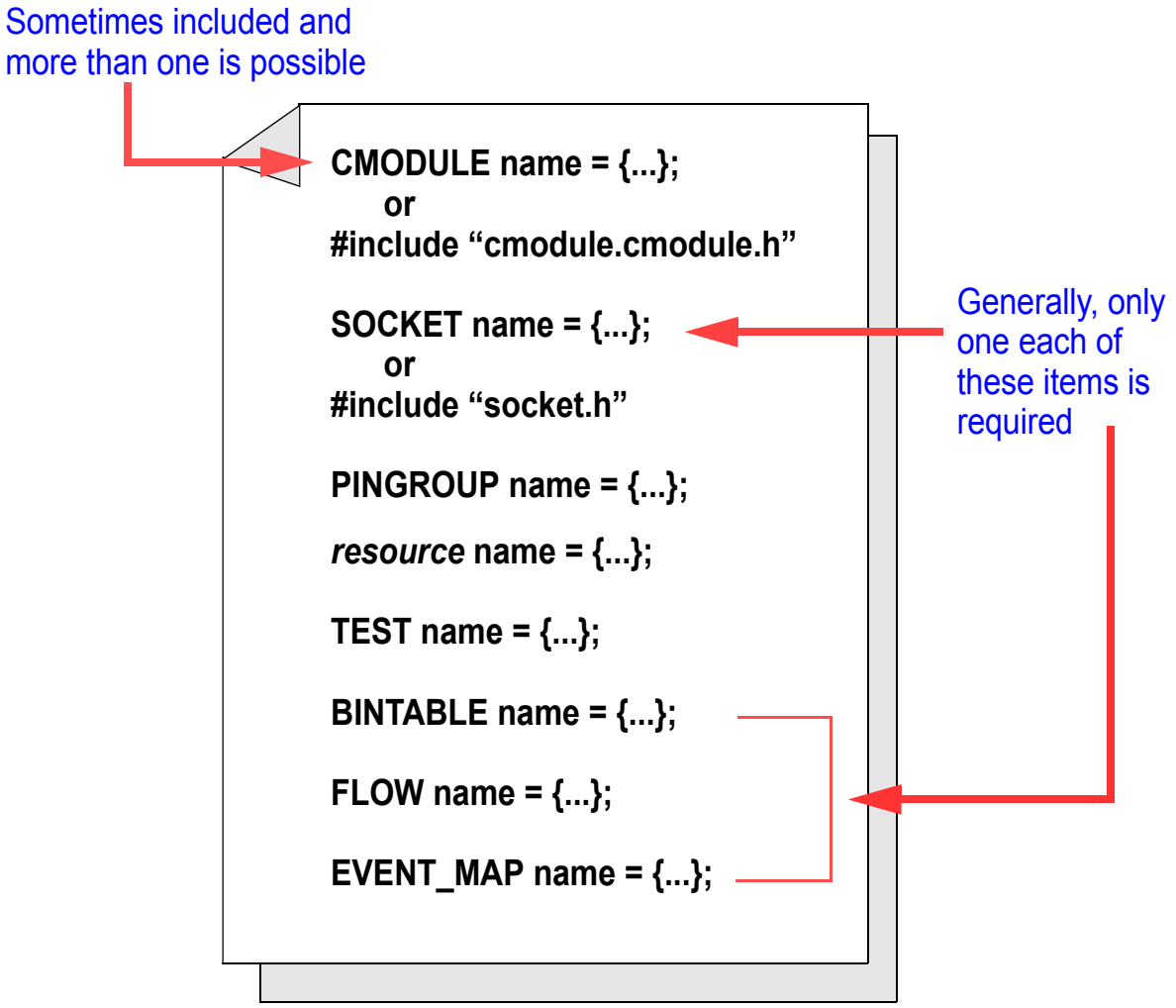
- **Test Containers** - For test operations
- **Bins** - End points in a flow
- **Flow** - Connection of tests and bins
- **Events** - Such as “start test” and “end of lot”
- **Resources** - Data used by various test operations
- **I/O specifications and pingroups**
- **User code** - C-Hooks

KTL Program File Layout

The organization of statements in a KTL file is dictated by one simple rule: “Nothing can be used unless it has been previously defined.” For example, the name of a test cannot be used in a flow statement before that test is defined in a test statement (the sequence actions of the test). The order in which the test is laid out in the test program is critical to the test makeup.

A recommended order of KTL statements is provided in Figure 26. Notice that the socket table, which defines all of the device pins, comes before the pingroups which use device pins in their definition. Next come several resource definitions which use pin names to program the hardware. These are followed by tests, which use resources in their sequences. The BINTABLE is defined next, although it can occur anywhere before FLOW. Then comes FLOW and EVENT_MAP, which use tests in their tables. Following this standard order helps to avoid compile errors.

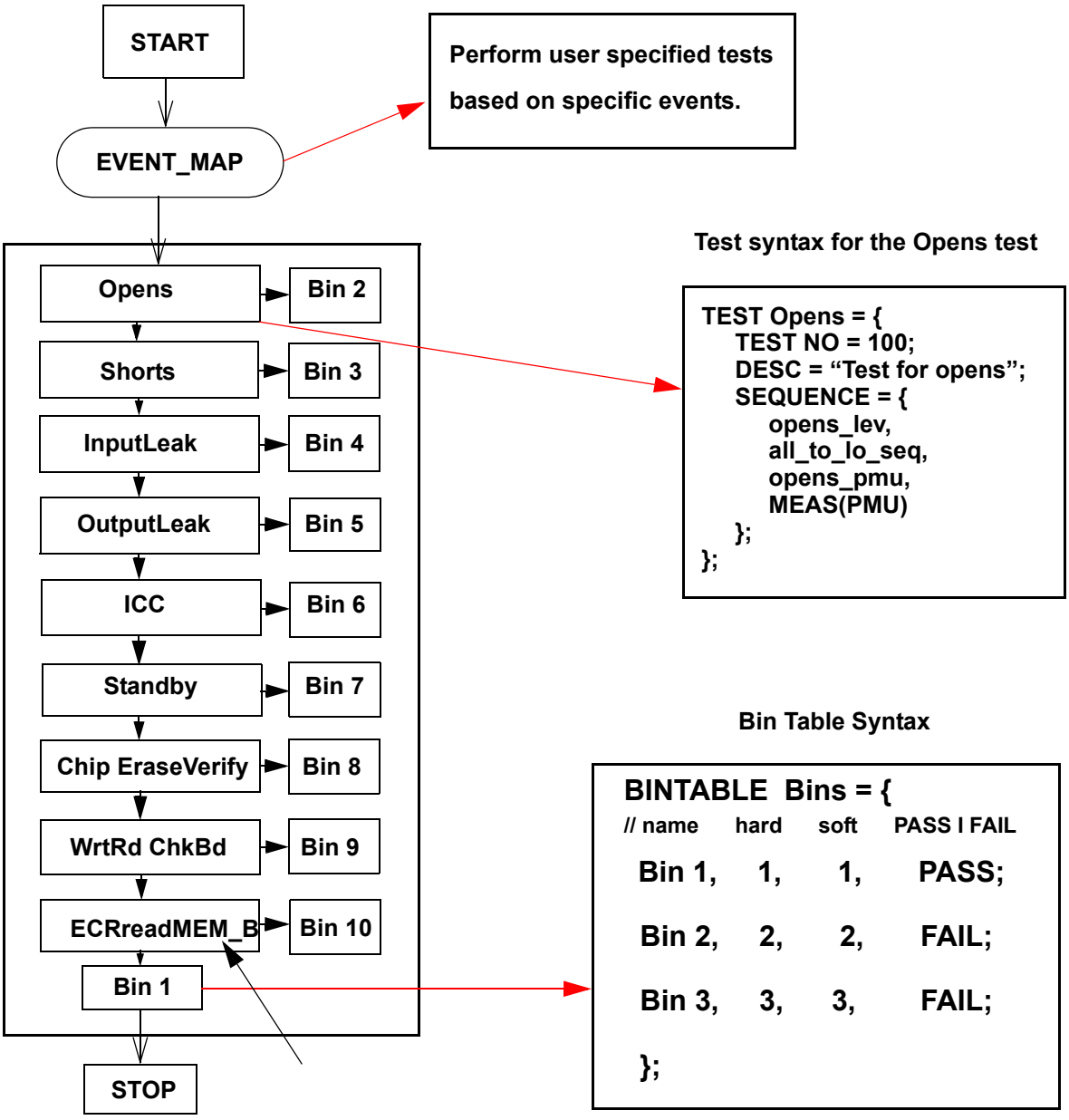
Figure 26. File Organization



The KTL is made up of several levels of abstraction. The highest level defines the sequence of tests that are performed, using references that then point to the next level of abstraction, which in turn is made up of references that point to another level of abstraction.

Figure 27 illustrates two of several levels of abstraction used in the KTL. The first level, the flow, defines which test is executed first. What follows depends on whether that test passes or fails. Typically, when a test fails, the device is assigned to a fail bin.

Figure 27. Flow Levels



Socket Table

The Socket table contains information for mapping device pins to tester channels (see Figure 28). It also defines the properties of each pin. Each device pin must be declared in the Socket Table before it can be assigned resources.

A device pin is designated by DPn, where n is a number from 1 to 1024 (768 + 256 non signal pins). There are at most 768 tester channels on a Kalos 2 16-board configuration, but there can be up to 256 non-signal pins (power, ground, and no-connect). Each pin is given a unique name which may be used to program resources or create pingroups.

Signal pins are given a type and default Pattern Generator (PG) assignment. Each pin may be assigned 1 to 4 channels on a Kalos 2 board, but all pins must have the same number of channels assigned. This is necessary for support of parallel test within each Kalos 2 slice.

Pin Types

Two pin types and assignments are accepted in the pin definitions in order to allow specification of the second half of extended cycles, where characteristics may differ from the first half. For example, DRAM devices with multiplexed address pins.

KTL supports up to 36 I/Os in the socket table that map to pattern generator resources. The I/O count is accumulated from input, output, and input/output pin types. Table 3 lists the allowed pin types and available assignments.

Table 3. Pin Types and Tester Resources

DUT Pin Type	Pin Type	Resource Designator	Tester Resource
Power pin	PWR_PIN	DPS	VCC0 to VCC31 VPP0 to VPP31
Ground pin	GND_PIN		
No connect	NC_PIN		
Input pin	INPUT_PIN	D0 ... D17, D18 ... D35	Tester Channel 1-768
Output pin	OUTPUT_PIN	O0 ... O17, O18 ... O35	Tester Channel 1-768
Clock pin	CLOCK_PIN	NA	Tester Channel 1-768
Address pin	ADDR_PIN	X0 ... X15, Y0 ... Y15, Z0 ... Z7	Tester Channel 1-768
Input/Output Pin	IO_PIN	IO0 ... IO17, IO18 ... IO35	Tester Channel 1-768

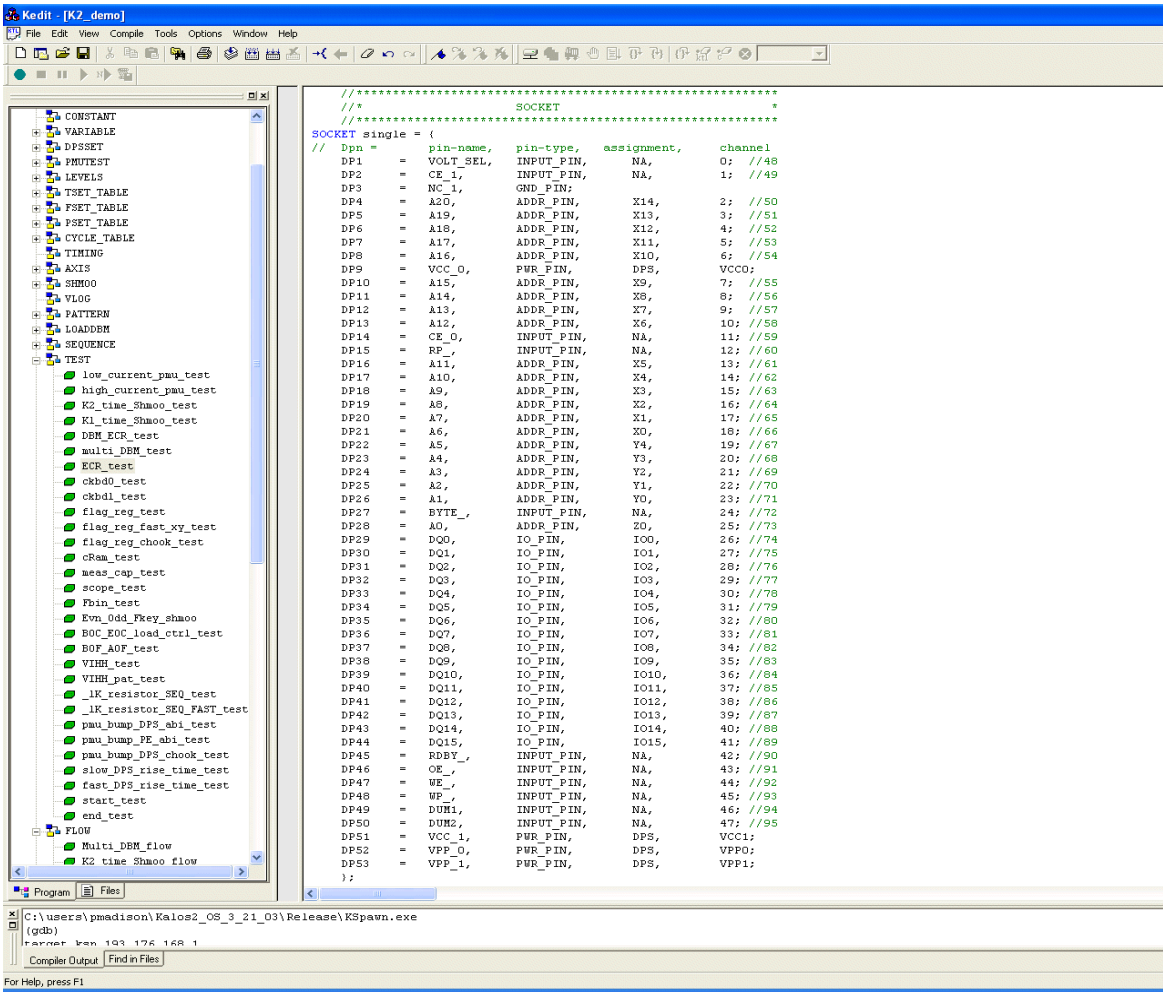
All signal pins must be mapped to a tester channel. Power pins should be mapped to a device power supply (DPS). Ground pins and no connect pins do not require a channel or assignment.

NOTE — The N/A means not assigned. For example a CE_ pin is an unassigned pin while an address pin is an assigned pin. Also, DQ represents data which is the same as a bidirectional pin (I/O pin). Use I/O in place of DQ in your socket table.

When testing more than one device with a single Kalos 2 slice (multi-DUT testing), the FLOW statement must always branch to a bin on a fail and all signal pins are connected to the same number of tester channels. However, this is subject to change in future revisions of software.

Although it is possible to use DPS1, etc. for identifying a power supply, using VCC0, etc., is recommended. Using a DPS identifier generates a warning message when compiling.

Figure 28. Socket Table

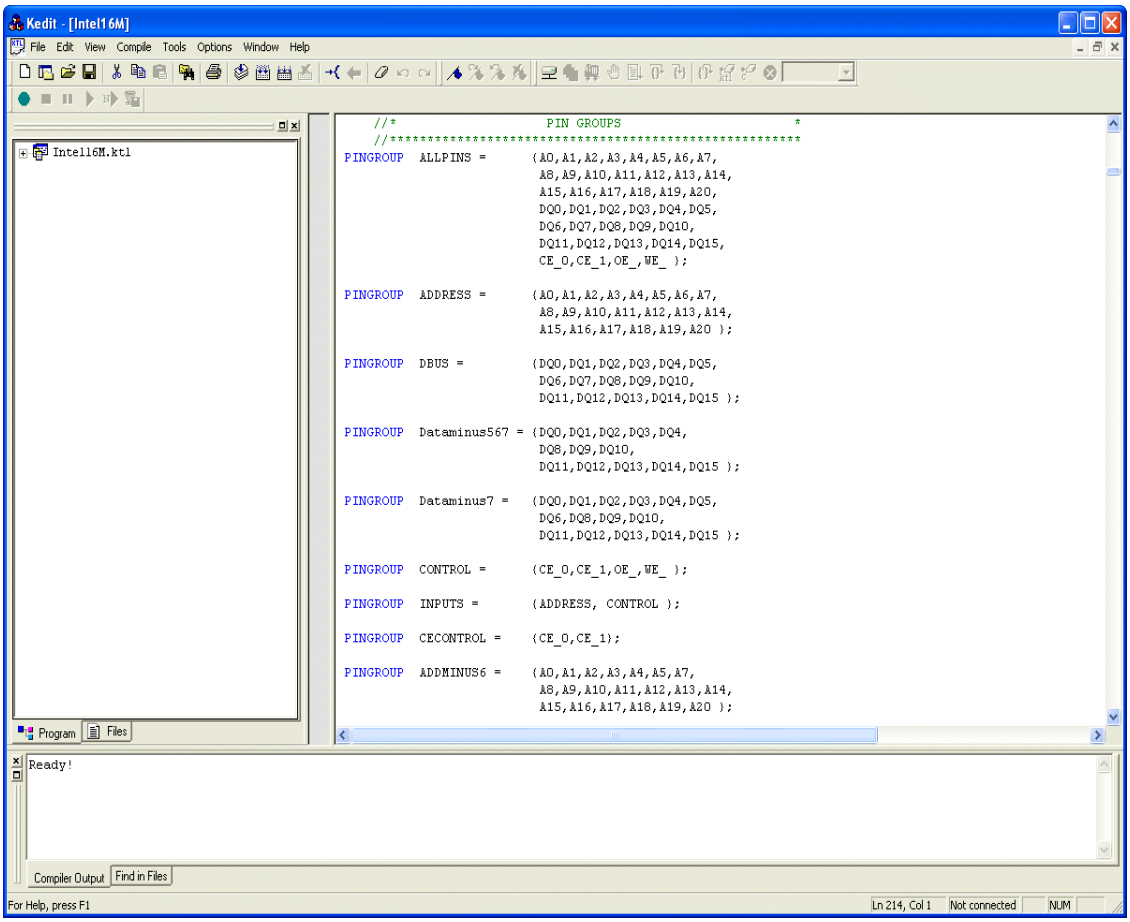


Pingroups

A pingroup is a user-defined collection of related pins (see Figure 29). The PINGROUP statement assigns a unique name to the pingroup and lists the device pins or other defined pingroups to include in it.

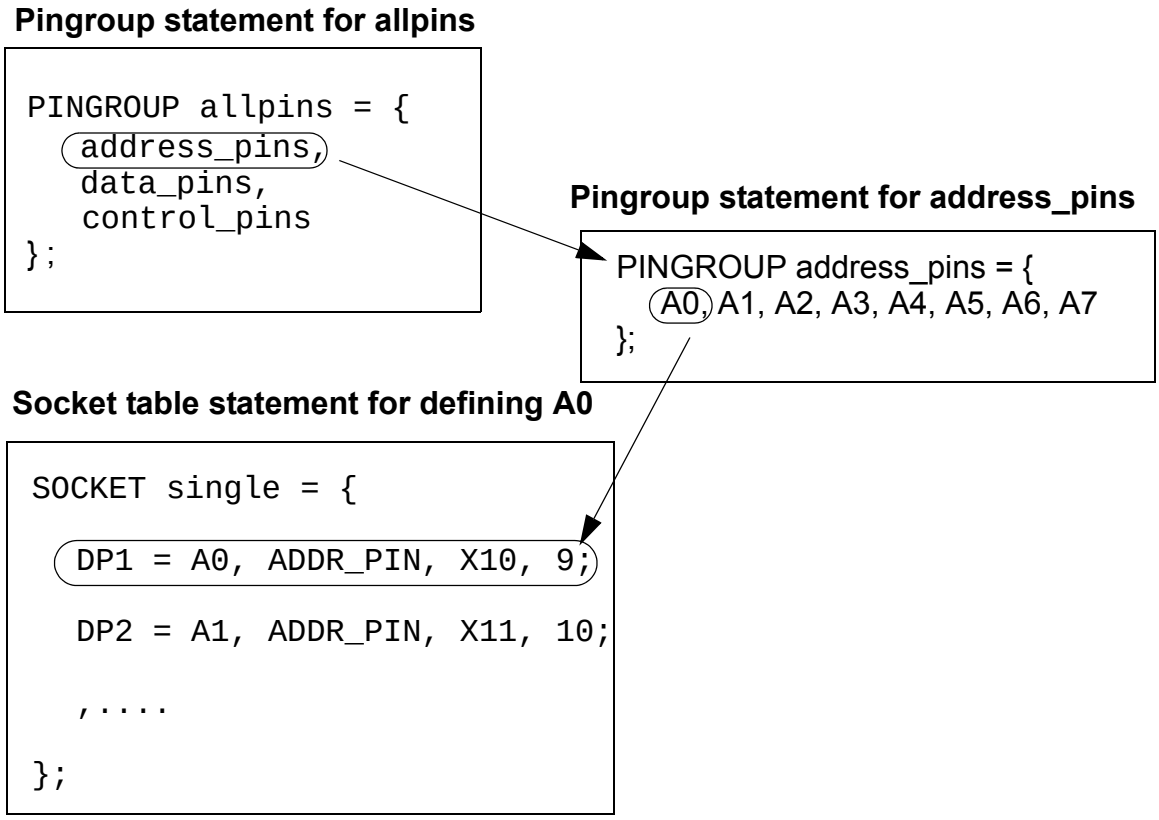
Defining pingroups is useful when there are several pins that are often used together in a test program; for example, pins that are part of a bus. Instead of listing each pin individually, all can be specified with one entry. This makes the test program more reliable, reduces its size, and decreases execution time.

Figure 29. Pingroups


Kedit - [Intel16M]
File Edit View Compile Tools Options Window Help
Intel16M.ktl
Program
Files
//* PIN GROUPS *
PINGROUP ALLPINS = (A0,A1,A2,A3,A4,A5,A6,A7, A8,A9,A10,A11,A12,A13,A14, A15,A16,A17,A18,A19,A20, DQ0,DQ1,DQ2,DQ3,DQ4,DQ5, DQ6,DQ7,DQ8,DQ9,DQ10, DQ11,DQ12,DQ13,DQ14,DQ15, CE_0,CE_1,OE_,WE_);
PINGROUP ADDRESS = (A0,A1,A2,A3,A4,A5,A6,A7, A8,A9,A10,A11,A12,A13,A14, A15,A16,A17,A18,A19,A20);
PINGROUP DBUS = (DQ0,DQ1,DQ2,DQ3,DQ4,DQ5, DQ6,DQ7,DQ8,DQ9,DQ10, DQ11,DQ12,DQ13,DQ14,DQ15);
PINGROUP Dataminus567 = (DQ0,DQ1,DQ2,DQ3,DQ4, DQ8,DQ9,DQ10, DQ11,DQ12,DQ13,DQ14,DQ15);
PINGROUP Dataminus7 = (DQ0,DQ1,DQ2,DQ3,DQ4,DQ5, DQ6,DQ8,DQ9,DQ10, DQ11,DQ12,DQ13,DQ14,DQ15);
PINGROUP CONTROL = (CE_0,CE_1,OE_,WE_);
PINGROUP INPUTS = (ADDRESS, CONTROL);
PINGROUP CECONTROL = (CE_0,CE_1);
PINGROUP ADDMINUS6 = (A0,A1,A2,A3,A4,A5,A7, A8,A9,A10,A11,A12,A13,A14, A15,A16,A17,A18,A19,A20);
Ready!
Compiler Output
Find in Files
For Help, press F1
Ln 214, Col 1
Not connected
NUM

An example of the interrelationship between the pingroups and the socket table is shown in Figure 30.

Figure 30. Pingroups and Socket Table Interrelationship



DC Tests Parametric

Tests contain and point to data that is used to perform actions and measurements on a device under test (DUT). Figure 31 shows basic DC test examples. This includes setting up the tester resources (DPS), stimulating the device (sending patterns to the DUT), and verifying the results (measuring parametric values or verifying patterns from the DUT). A test statement defines a point in a flow which consists of an entry point and two exit points: one for pass and one for fail.

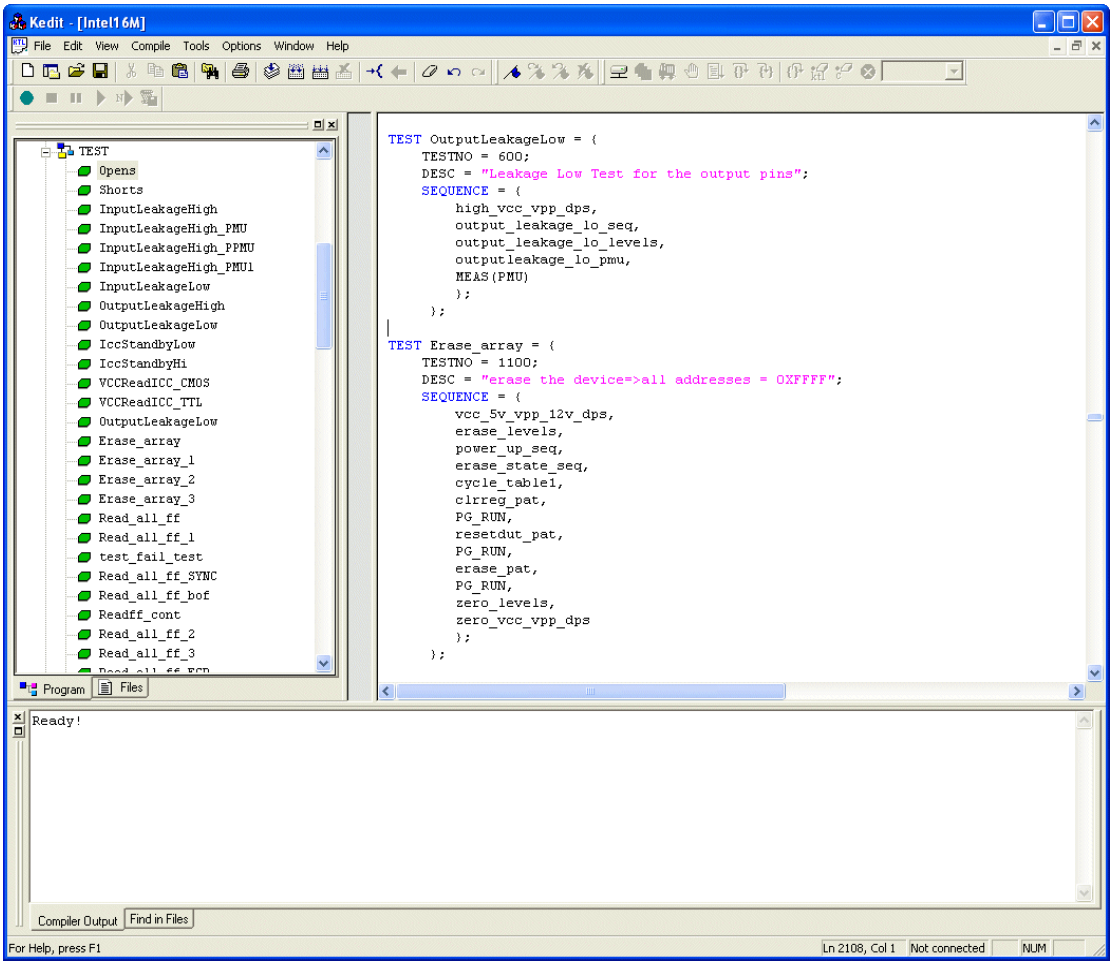
Each test has an associated pass/fail counter which is initialized to a 0 whenever a test is created. Each time the test is executed, one of the pass/fail counters increments to reflect the test result. These counters are used to track part of the statistical data that is provided in summaries.

Tests should be completely self-contained. Any step required to perform a measurement or other action should be included in the sequence. This allows for movement within the flow or deletions without effecting other tests. This also facilitates the development of test libraries, which help to reduce program development time.

Each test statement may contain a test name and number, a description of up to 1023 characters, and a sequence. The test number can be any positive integer. The test name cannot be repeated but the test number can.

Depending on the nature of a test, its sequence may contain data to be applied to the tester, known as resources: actions, such as taking a measurement and/or references to the user code, known as a C-Hook. When the test is executed, each item in the sequence executes in order until a failure occurs or all items are completed. Refer to the SEQUENCE section in the Kalos 2 Test Language chapter, of the *KITE Reference Manual*, for a list of available actions.

Figure 31. DC Tests



Functional Test

Functional testing verifies that the DUT correctly performs its intended logical functions. These tests verify functionality of the device by applying pattern vectors, which detect faults within the DUT. These vectors apply all the necessary input signals, and monitor the output signals to determine pass/fail results.

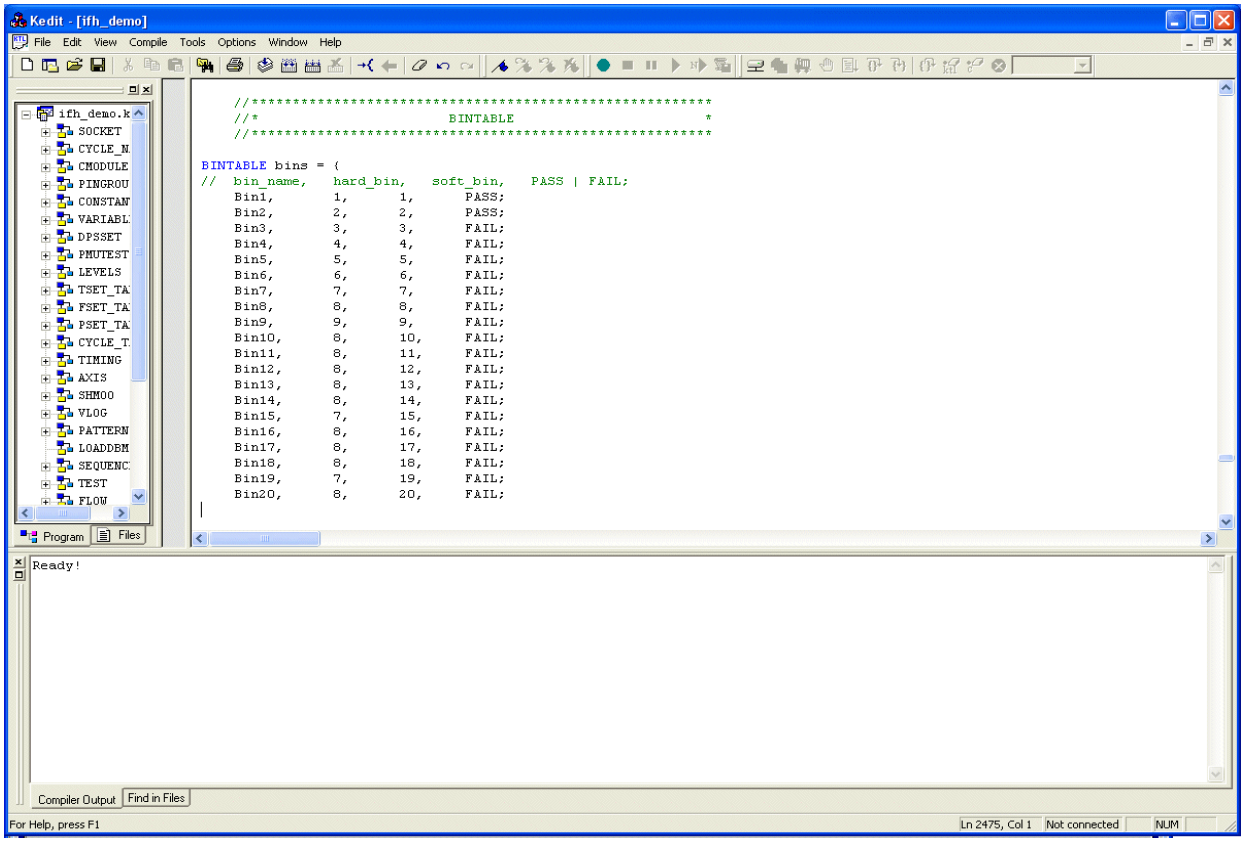
Bin Table

A Bin Table is a statement which contains information for sorting tested devices into appropriate groups, known as bins, based on pass or fail results. Since the result of testing a device is to assign it to a bin, a bin is also considered an end point in a flow.

There are 32 hardware and 1024 software bins available for each test program.

- Hardware bins are used to physically separate devices using a mechanical handler or prober.
- Software bins facilitate the collection of summary information for tested devices by recording the number of times a test branches to each device. In order to interpret the data this generates, each software bin should be assigned a unique bin number. Once a test branches to a bin, the testing of the DUT is complete and the binning information is logged to the workstation computer (see Figure 32).

Figure 32. Bin Table



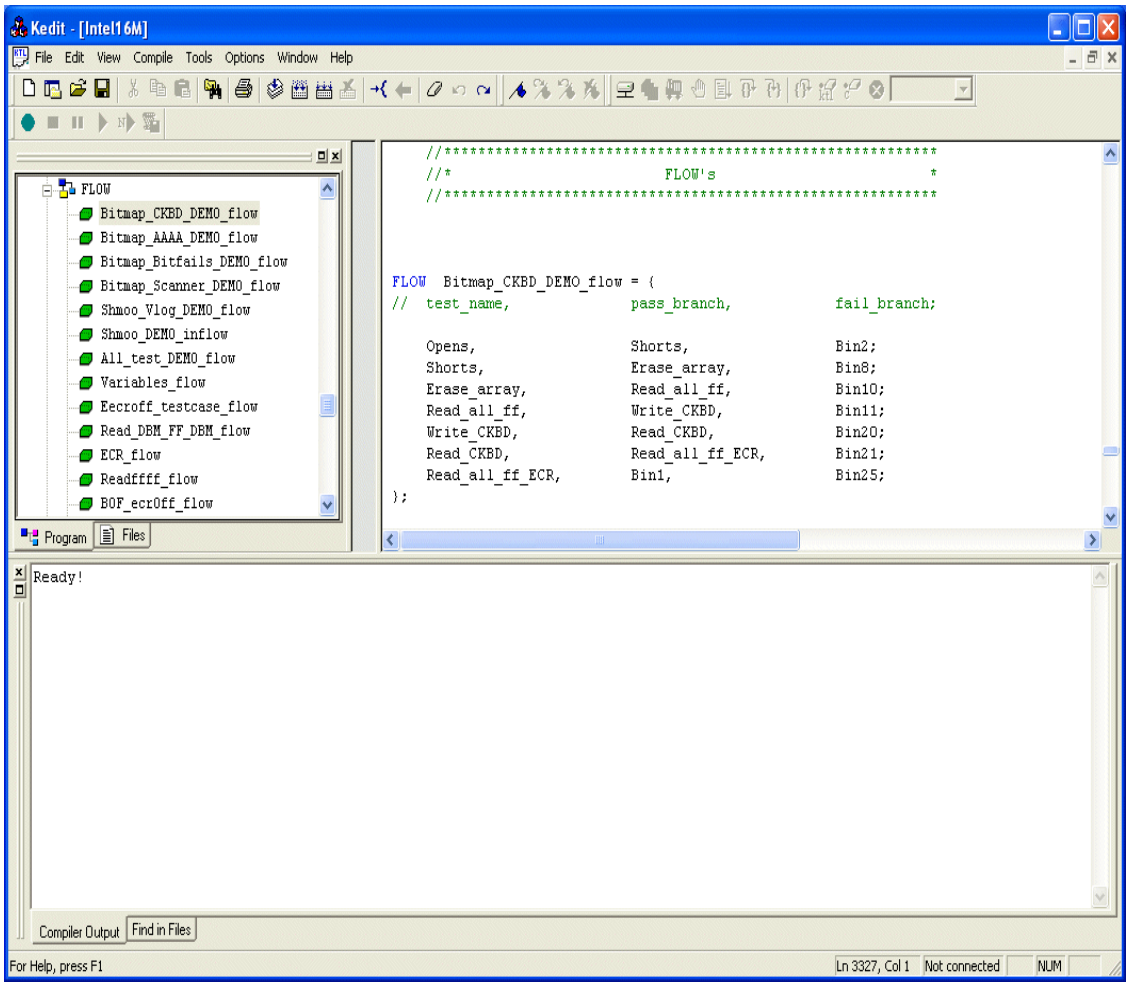
Flow Statement

A flow statement defines the order in which tests of a Kalos 2 test program are executed and the manner in which tests and bins are connected. When a test is executed, it results in a pass or a fail. Based on that result, the flow branches to another test or a bin.

Typically when the test passes, the flow directs the system to go on to the next test until all tests are executed. When the device is assigned a pass bin, testing stops. When a test fails, the device is assigned a fail bin and testing stops without performing other tests.

As shown in Figure 33, the flow statement consists of three columns. The first column contains the name of the test to be executed. The second column contains the name of the test or bin to be branched to when a pass result is received. The third column contains the name of the test or bin to be branched to when a fail result is received.

Figure 33. Flow Statement



Program Files

The KTL file contains various statement blocks, most of which are given a unique name. The following are brief descriptions of typical KTL statements. These statements are possible parts that can be used in a test program run. For in-depth information on each KTL statement, refer to the applicable section of the Kalos 2 Test Language (KTL) Chapter in *KITE Reference Manual*.

CYCLE_NAMES

The CYCLE_NAMES statement lists the names used for cycles in both the CYCLE_TABLE statement and pattern file. If a test program contains any CYCLE_TABLE statements, a CYCLE_NAMES statement is required, and only one is allowed.

CONSTANT

A program is easier to read and change if certain numbers are assigned a name. A CONSTANT statement assigns a unique name to a defined value. Once defined, a CONSTANT is substituted anywhere within the test program where a value or variable expression (var-expr) is used.

VARIABLE

A VARIABLE is a storage place for numbers. When it is created it is assigned a unique name and a value using the VARIABLE statement. Once created and assigned a value it may be substituted anywhere within the test program where a number would normally be used. The DPSSET, PMUTEST, TSET_TABLE, PSET_TABLE, TIMING, and LEVELS all accept variable expressions (var-expr) when assigning values to their associated resources.

DPSSET

The DPSSET statement sets up the device power supplies. There are four device power supplies on each Kalos 2 slice. For the Kalos 2 (xp), eight device power supplies are available on each Kalos 2 slice. Two/four are referred to as VCC (normal voltage) supplies and two/four are referred to as VPP (high voltage) supplies.

PMUTEST

The PMUTEST statement is used to set up measurements for the system parametric measurement unit (PMU). The system PMU supports a full range of operation.

LEVELS

The LEVELS statement defines the voltages to be used for driving input data, comparing output data, and performing current loading. Levels on the Kalos 2 system are per-pin. Each pin has three driver levels (VIL, VIH, and VIHH), two output compare levels (VOL and VOH), and two current loads (IOL and IOH) which are triggered by the DUT output crossing the threshold voltage VTH. VTH is a reference voltage set somewhere between VOH and VOL that determines when to source or

sink current to or from the DUT. If the DUT output goes above VTH, the IOH current load turns on and sinks current from the DUT. If the DUT output goes below VTH, the IOL current load turns on and sources current to the DUT.

EDGESET

The EDGESET statement contains the timing (tset), format (fset), and period information used to completely define the waveforms for each pin of each cycle.

AXIS

The AXIS statement specifies the parameters used in generating Value Log (VLOG) data and Shmoo plots.

SHMOO

The SHMOO statement specifies the parameters for generating a Shmoo plot. A Shmoo plot graphs the PASS/FAIL result of testing a device while changing one or more of the test parameters.

VLOG

The VLOG statement allows users to find the PASS/FAIL transition point while test conditions are changed. One “AXIS” can change several resources. For example, the VLOG statement can ramp the strobe time from a short time to a long time to determine when an output goes to the expected logic level. This value can be saved in a variable and displayed or used to make runtime decisions.

PATTERN

The PATTERN statement specifies the source file of the test patterns, where in memory to load the test patterns, and what to do if a fail occurs. The pattern data source file is referred to by its file name and must be in the same directory as the test program at load time.

LOADDBM

The LOADDBM statement causes an Intel hexadecimal (HEX) object file to be loaded into the Data Buffer Memory (DBM) in either MEM_A or MEM_B. This is only performed once—at the time the KTL test program is loaded. Multiple files may be loaded and are stored in a DRAM file system.

SEQUENCE

The SEQUENCE statement provides a way to define a test sequence external to the TEST statement. Sequences may be embedded in other SEQUENCE statements such as in a SEQUENCE parameter in a TEST statement.

CMODULE

KTL supports the use of C programming code within a test program by referencing it using the CMODULE statement. This capability provides the user with access to the full power of the C programming language and the standard ANSII C library.

EVENT_MAP

Typically tests are run based on the order specified in a flow statement. The EVENT_MAP statement permits running specific tests based on the occurrence of an event. There are seven events that the EVENT_MAP statement looks for to trigger the running of a user specified test.

CONFIG

The CONFIG statement provides two functions. One is to allow the user to select which FLOW and initialization SEQUENCE to activate when loading a test program. The second is to run specific tests based on the occurrence of an event. This second feature is similar to the function of the EVENT_MAP statement.

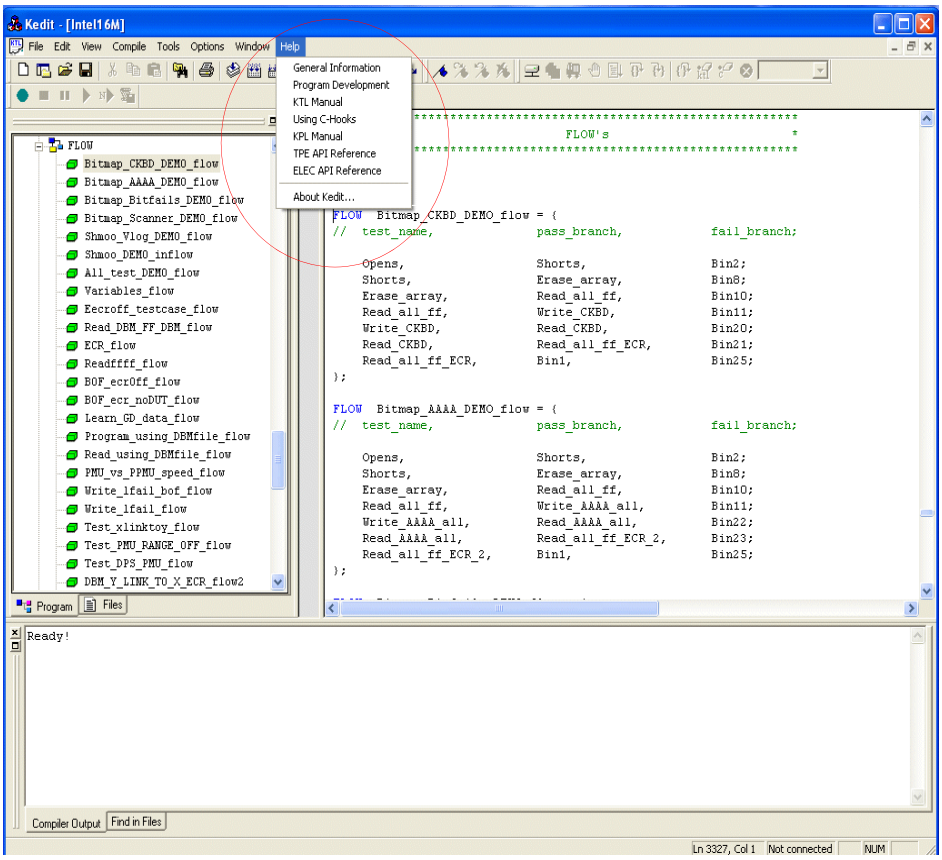
Online Help Documentation

The Kalos 2 documentation set is a collection of Credence manuals and technical documents which have been prepared for online viewing using Adobe Acrobat Reader.

To view the documentation, Adobe Acrobat Reader with Search must be installed on the computer. The 32-bit version of Reader with Search for Windows is included on the Kalos 2 CD. To install it, locate the file named rs405eng.exe and double click on its icon. (Installation instructions can also be found in the Readme.txt file located on the Kalos 2 CD.) Follow the instructions provided by the Adobe installation wizard to complete the task.

To access Kalos 2 documentation, insert the CD into the CD-ROM drive of the computer. If the KITE software installation contained on the CD was run previously, the documentation is already loaded into the Kalos/doc directory. The documentation can be accessed by selecting the Help menu on Kedit application, as shown in Figure 34, or by double clicking on *KITE_Reference_Manual.pdf* or *User_Manual.pdf* files located in the Kalos/doc directory. These files launch the Kalos 2 KITE Reference Manual and the Kalos 2 User Manual, respectively.

Figure 34. Kedit Online Help



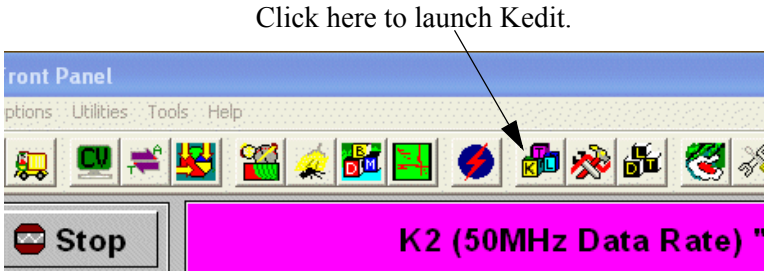
Kedit

The Kedit utility is a Kalos 2 supplied text editor. Kedit is used to generate, edit, compile, and debug test programs.

Launching Kedit

Kedit can be launched by clicking on the KTL icon located on the toolbar of Front Panel (see Figure 35) or by selecting Utilities => KEDIT from the menu bar. Kedit can also be launched from the Kalos 2 bin directory by double clicking on the Kedit application.

Figure 35. Kedit Icon



NOTE — For easy accessibility, a Kedit shortcut can be created.

Program Loading

Once the editor is launched, click the left mouse button on the file pulldown menu (see Figure 36). From this pulldown menu a program can be selected for loading. Options include: New to create a new file; Open to load a file; Open Workspace to edit an existing file. Additional options are provided to save, print, close, and review recent files.

Figure 36. Program Load and Workspace

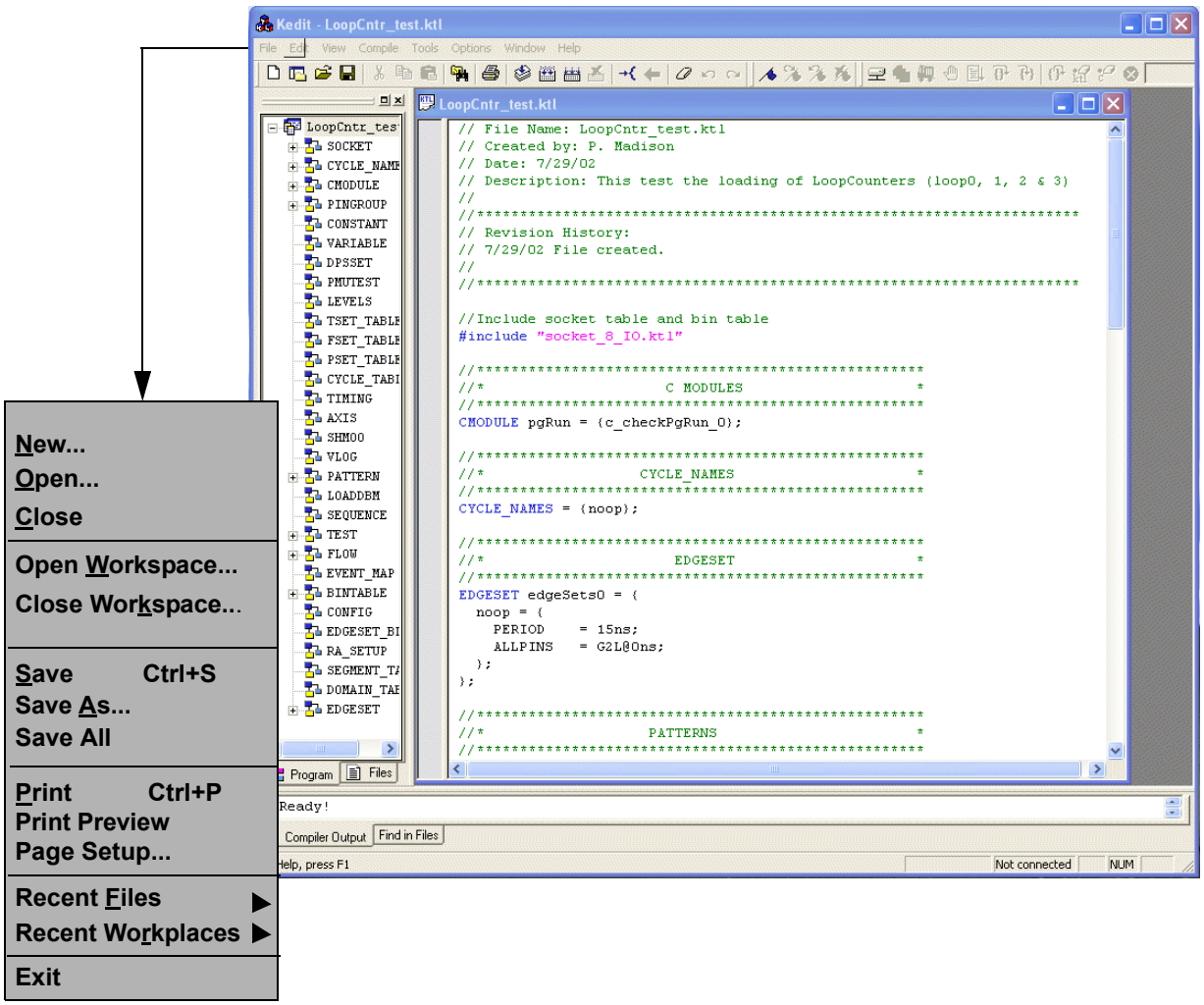


Table 4 provides a description for each menu option in the *File* pulldown window.

Table 4. Kedit - File Menu Description

Option	Function
File	
New	Create a new KPL, KTL, KPJ, C, or Other (text) file.
Open	Open an existing file.
Close	Close the opened test program file.

Table 4. Kedit - File Menu Description *(Cont.)*

Option	Function
Open Workspace...	Open a workspace file for editing/modifications.
Close Workspace...	Close opened workspace file and all associated files.
Save	Save edits/modifications.
Save As...	Save an opened file under another name or to another location.
Save All	Save all modified files.
Print	Print a file to a specified printer.
Print Preview	View file as it will appear in print.
Page Setup...	Setup printing specifications.
Recent Files	View file names of the previous four files opened.
Recent Workspaces	View workspace names of the previous four workspaces opened.
Exit	Exit Kedit.

Concept of the Workspace

When using Kedit, you can open a Workspace to enable modification or creation of associated files (KPJ, C, KTL, and KPL files). When KPJ or KTL files are opened as a workspace, all associated C and KPL files also open. A test program opened as a workspace enables navigation using resource icons, as shown in Figure 37, as well as the use of the Files tab. The Files tab is used to view the files associated with the program. The workspace also enables the Resource Completion feature, and mouse fly-by selected tool tips, that indicate the type of resource symbols.

Fly-by tool tips are messages that appear when the mouse cursor passes over a word in a text field or other GUI object, such as a toolbar icon. In .ktl files, Kedit produces a fly-by display of the resource type of symbols defined with resource keywords. A keywords list of supported fly-by tool tips follows:

SOCKET

CYCLE_NAMES

CMODULE

PINGROUP

DPSSET

PMUTEST

LEVELS

TSET_TABLE

FSET_TABLE

SHMOO

VLOG

AXIS

PSET_TABLE

CYCLE_TABLE

PATTERN

SEQUENCE

TEST

VARIABLE

FLOW

EVENT_MAP

BINTABLE

LOADDBM

CONFIG

TIMING

CONSTANT

CYCLE_NAMES

EDGESET

Kedit provides resource completion templates in the form of tool tips for the keywords shown in Table 5. The template string is displayed after the "{" character is entered when defining a new resource.

Table 5. Resource Fly-By Tool Tips

Resource Keyword	Template
CMODULE	function,

Table 5. Resource Fly-By Tool Tips *(Cont.)*

Resource Keyword	Template
FLOW	test_name, pass_branch, fail_branch;
BINTABLE	bin_name, bin_no, soft_no, PASS | FAIL;
SOCKET	DP# = name, type, assign, channel;

To open a Workspace, select *File => Open Workspace*, and a browser menu appears that allows you to select the test program you wish to edit or modify, as well as its associated files. A new Workspace can be created from an existing Workspace by opening the file and renaming it. This is accomplished by selecting *File => Save As*, and a browser menu appears. Enter the name of the new file and select *Save*. To create a new Workspace, click the left mouse button on View and ensure *Workspace* is selected. Then from the File menu, select *New*, and a window appears from which you can elect to create a new file: KPL, KTL, KPJ, C, or Other.

Resource Icons

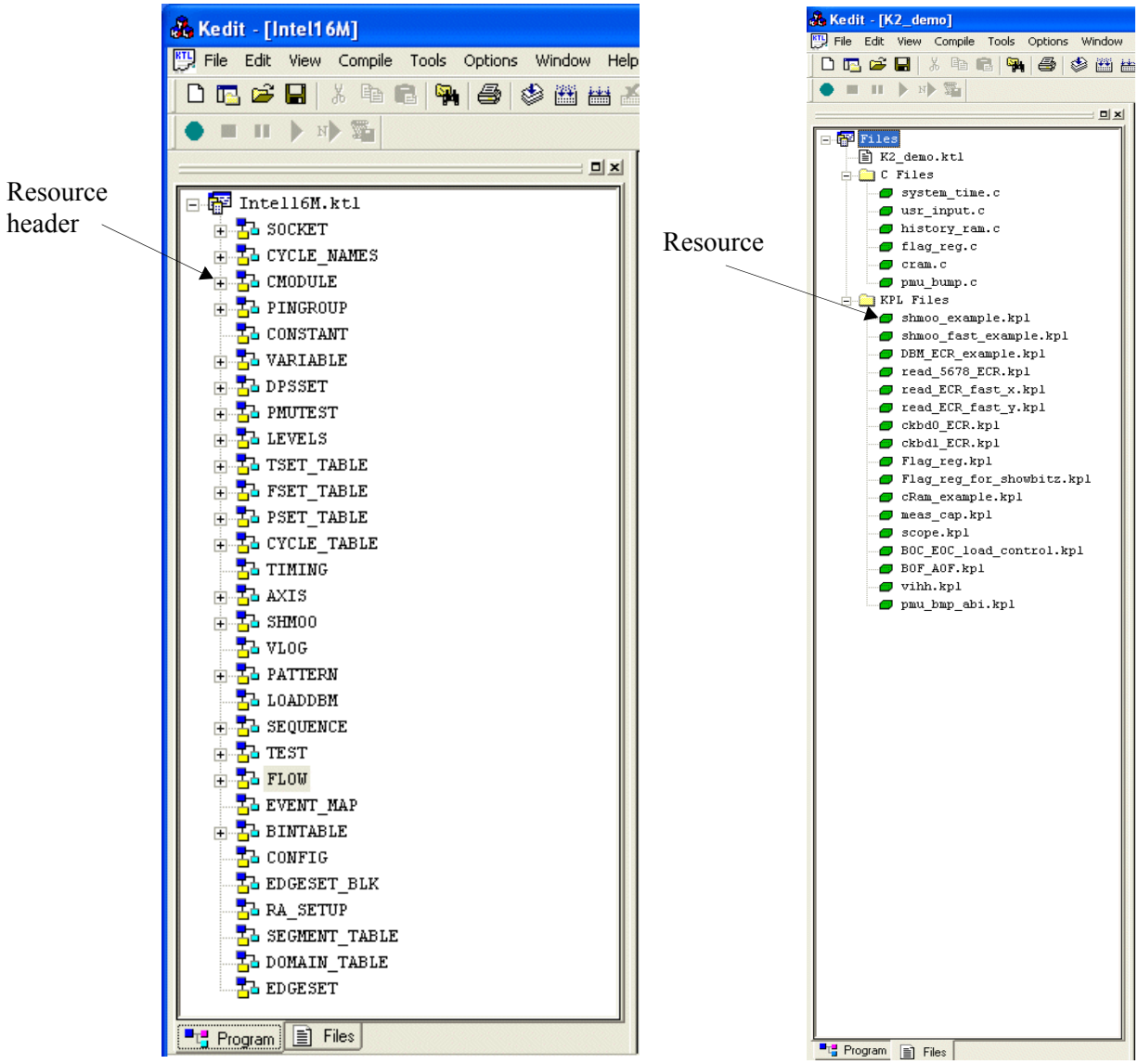
The resource icons (see Figure 37) allow you to go to the location in the test program of specific resources by clicking on the item with the left mouse button. It initially shows the keywords for resources in the test program and works much like the Windows Explorer.

NOTE — This feature is activated only for test programs opened as a workspace.

When the positive (+) symbol to the left of the name of the resource you wish to view is clicked, a list of the items that make up that resource can be viewed. For example: Clicking on the positive symbol next to CYCLE_TABLE lists the CYCLE_TABLEs in the program. Double click on the desired entry to view and/or edit that location in the program.

When a resource is selected, a minus (-) symbol appears to the left, replacing the positive symbol. If you no longer wish to view the individual entries, click on the minus symbol to close the list of files. Double click on the desired entry to view and/or edit the file in that location. These functions allow for quick and convenient test program navigation. The blue arrow (pointing to the left) on the toolbar allows you to go one selection back.

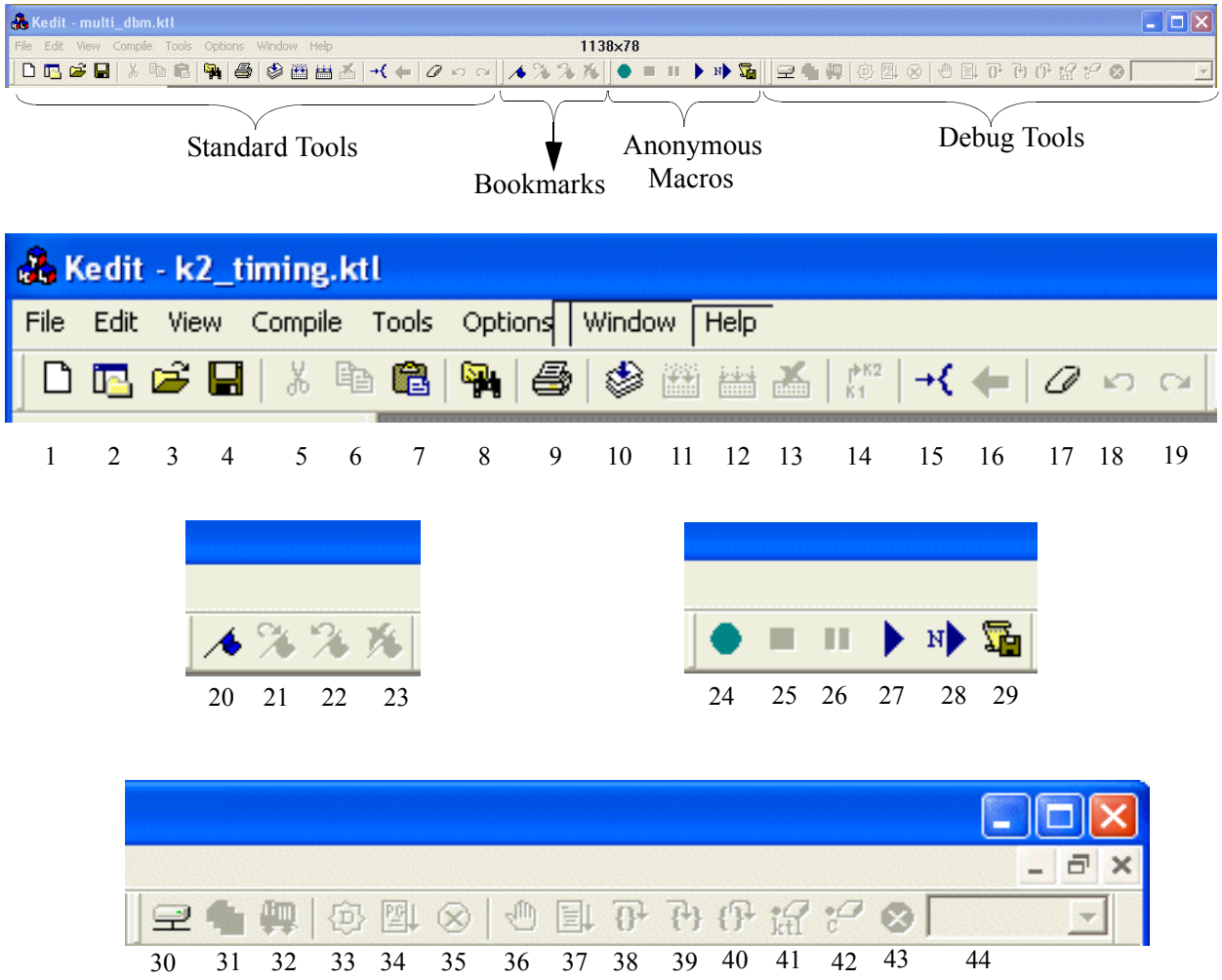
Figure 37. Resource Icons



Navigation and Edit Tools

Navigating while using the toolbar (see Figure 38) provides the user with options to perform functions that can be performed using pulldown menus. The Kedit toolbar consists of four sections: Standard Tools, Bookmarks, Anonymous Macros, and Debug Tools.

Figure 38. Toolbars


Kedit - multi_dbm.ktl
File Edit View Compile Tools Options Window Help
1138x78
Standard Tools
Bookmarks
Anonymous Macros
Debug Tools
Kedit - k2_timing.ktl
File Edit View Compile Tools Options Window Help
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
20 21 22 23
24 25 26 27 28 29
30 31 32 33 34 35 36 37 38 39 40 41 42 43 44

Standard Tools

These tool icons perform standard functions found in similar applications. These functions include file operations such as open and close, edit operations such as undo and redo, and project operations such as compile and build.

Bookmarks

These tool icons perform bookmarking functions that allow for quicker movement within the editing environment and flagging of syntax.

Anonymous Macros

Macros provide a shortcut to typing a sequence of commands that are applied repeatedly to a body of text. One use is inserting a space at the beginning of each line.

Debug Tools

These tool icons perform debug operations such as setting or clearing breakpoints, and controlling the flow of execution through the test program. Refer to the Debugging Using Kedit section of this chapter for additional information, and details on using this tool.

Tool Functions

The following is a functional description of each tool (icon) on the toolbar.

Standard Tools

1. **New** - Allows the user to create new files of which the type must be specified.
2. **Open Workspace** - Brings up a pop-up window which allows the user to select a file to open as a workspace.
3. **Open** - Allows the user to open a file to be used with Kedit.
4. **Save** - Saves the changes made on a workspace or Kedit.
5. **Cut** - Cuts the highlighted section of a file.
6. **Copy** - Allows the user to select and copy part of a file.
7. **Paste** - Allows the user to paste the copied part of a file to another part of the file or a different file.
8. **Find in Files** - Search engine to find files, etc.
9. **Print** - Allows the user to print the file.
10. **Compile File** - Recompiles only the file in the current document window.
11. **Build** - Recompiles all files that were updated/modified in the current project workspace.
12. **Rebuild All** - Recompiles all files in the workspace.
13. **Stop Build** - Stops the build of the current project workspace.
14. **K1 to K2** - Translates Kalos 1 syntax (CYCLE_TABLE) to Kalos 2 syntax (EDGESET).

15. **Brace matching** - Bounces between brace pairs to ensure proper brace matching (matches up a brace at the same nested level).
16. **Back To Reference Point** - Goes back to previous reference point. May be used successively.
17. **Clear Output Window** - Clears the output window.
18. **Undo** - Undo the last entry or change.
19. **Redo** - Redo the last entry or change.

Bookmarks

20. **Toggle Bookmark** - Toggles (on/off) a bookmark for the current line.
21. **Next Bookmark** - Moves to the line containing the next bookmark.
22. **Previous Bookmark** - Moves to the line containing the previous bookmark.
23. **Clear all Bookmarks** - Clears all bookmarks in the window.

Anonymous Macros

24. **Start Recording Anonymous Macro** - Records each keystroke for playback until Stop Recording is clicked.
25. **Stop Recording Macro** - Stop the current macro.
26. **Pause Recording** - Allow other commands before resuming recording.
27. **Play Anonymous Macro Once** - Play the last recorded macro.
28. **Play Anonymous Macro Many** - Play the last recorded macro N times. (Dialogue box prompts you to indicate how many times.)
29. **Save Anonymous Macro** - Save the last recorded macro to a file.

Debug Tools

30. **Online/Offline** - Online mode enables debugging through Kedit. Offline mode enables test program modification and compiling.
31. **Load Project** - After selecting a slice, load the Kalos 2 project file.
32. **Load Program** - After selecting a slice, load the Kalos 2 test program.
33. **Start KTL Debugging** - Enables debugging for the last loaded pattern.
34. **Run PG** - Allows the user to burst the last loaded pattern in debug mode.
35. **Stop PG** - Stops pattern burst in debug mode.
36. **Insert/Remove Breakpoint** - Toggles breakpoint at the line where the cursor is positioned.

37. **Start/Continue Test** - Starts or resumes testing after a breakpoint.
38. **Step over** - Execute the test element at cursor location.
39. **Step into** - Execute the test element one level below cursor location.
40. **Step Out** - Execute until next test element one level above cursor location.
41. **Clear All KTL Breakpoints** - Remove breakpoints from all lines in test program.
42. **Clear All C Breakpoints** - Remove breakpoints from all lines in C file.
43. **Stop test** - Stops the test.
44. **List of active modules** - The first step in debugging is to select the Kalos 2 slice where debugging is to occur.

Pulldown Menus

In Kedit, pulldown menu options are available (see Figure 39) which allow the user to edit and navigate through the test program. Table 4 and Table 6 provide a description of each menu option.

Figure 39. Pulldown Menu Items

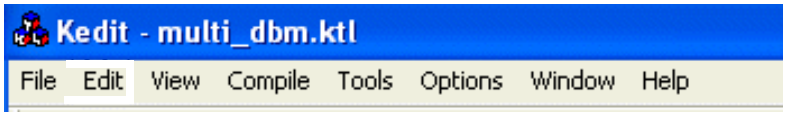


Table 6. Kedit Menu Bar Description

Option	Function
Edit	
Undo	Undo the last entry or change.
Redo	Redo the last entry or change.
Cut	Cuts the highlighted section of a file.
Copy	Allows the user to select and copy part of a file.
Paste	Allows the user to paste the copied part of a file to another part of the file or a different file.
Select All	Highlight all text in the file.

Table 6. Kedit Menu Bar Description *(Cont.)*

Option	Function
Find...	Search engine to find text in the current file.
Find Next	Find next occurrence in the current file.
Replace...	Find and replace text within the current file.
Go to...	Position to line in file based on line number, compile error or bookmarks.
Brace Matching	Bounces between brace pairs to ensure proper brace matching (matches up a brace at the same nested level).
Back to Reference Point	Goes back to previous reference point only. May be used successively.
Tabify Selection	Not currently available.
Untabify Selection	Not currently available.
Format Selection	Not currently available.
View	
Toolbar	Enable/disable presence of toolbar.
Status Bar	Enable/disable presence of status bar.
Workspace	Enable/disable presence of workspace.
Output	Enable/disable presence of output tools.
Bookmarks	
Macros	Enable/disable presence of macro tools.
Debug	Enable/disable presence of debug tools.
Debug Dialog	Displays debug views for online debugging.
Datalog Dialog	Displays PG and TG datalog results (captured under specified storage conditions) after the pattern burst.
Compile	
Compile File	Recompiles only the current file.
Build	Recompiles all files that were updated/modified in the current project workspace.
Rebuild All	Recompiles all files in the workspace.

Table 6. Kedit Menu Bar Description *(Cont.)*

Option	Function
Stop Build	Stops the build of the current project workspace.
Translate ktl from K1 to K2 timing	Translates Kalos 1 syntax (CYCLE_TABLE) to Kalos 2 syntax (EDGESET).
Tools	
Find in Files...	Search engine to find text in a set of files.
Macros...	Manipulate saved macros.
Start Recording Anonymous Macro	Records each keystroke for playback until Stop Recording is clicked.
Stop Recording Macro	Stop the current macro.
Play Anonymous Macro Once	Play the last recorded macro.
Play Anonymous Macro Many...	Play the last recorded macro N times.
Save Anonymous Macro...	Save the last recorded macro to a file.
Options	
Saving...	Select options for backups and auto save.
Resource Completion...	Enable or disable tool tips when defining new resources.
Format...	Sets the format of the active window file: foreground/ background, color, font size, etc.
Tabs...	Sets tabs and/or auto indent for all files.
Compiler Options...	Select C and KTL compile options.
Window	
Cascade	Puts all opened files in cascade order in the window; putting one file in front of the other cascading down.
Tile	Sets all opened files in a tile look, splitting the work environment into equal parts showing all loaded files at once.

Table 6. Kedit Menu Bar Description *(Cont.)*

Option	Function
Arrange Icons	Arranges the minimized files automatically.
Help	Select PDF format reference file.
About Kedit	Display Kedit version information.

Navigating in Kedit

In addition to using the Explore Icons, there are other ways to navigate in Kedit. Users can click the left mouse button on a table name or object, then click the right mouse button and a pop-up appears. The pop-up enables one of the two following text lines:

Open Document *Name of file*

Go To Definition Of *Name resource*

- ***"Go To Definition Of _____"*** takes the user to the defining text within the program where the resource resides.
- ***"Open Document _____.kpl"*** takes the user to the external KPL file that defines this particular pattern.
- ***"Open Document _____.c"*** takes the user to the C source file which defines the CMODULE.

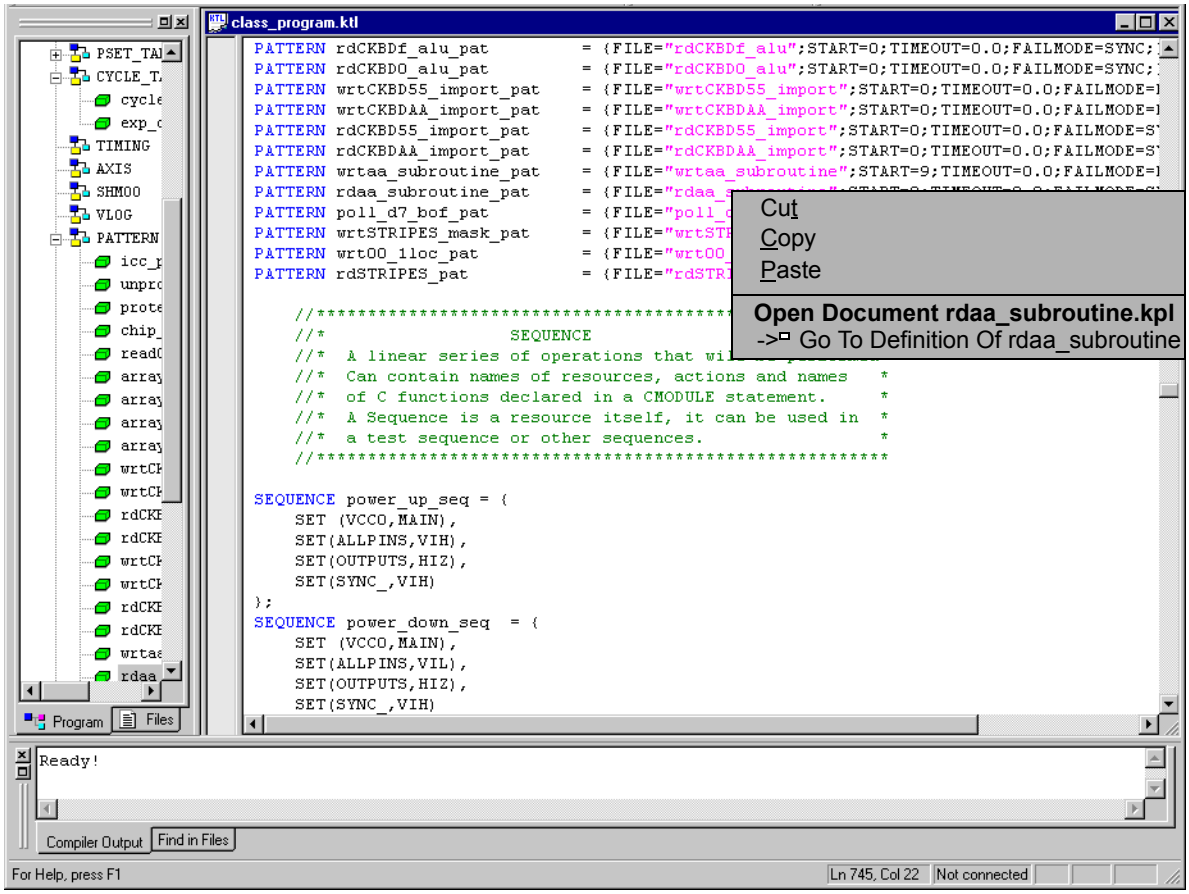
The example in Figure 40 opens the pattern file called rdaa_subroutine.kpl.

If both options are grayed (disabled), the object is unknown within the project.

NOTE — When clicking the right mouse button on a pattern or a CMODULE, the standard Go To Definition Of _____ pop-up appears. However, when clicked, followed by a pop-up: The _____ is undefined appears, indicates that the file does not exist within the KTL project.

Users can use the scroll bar on the right and bottom when navigating through the active window, as well as use the *Back To Reference Point* arrow on the toolbar to successively go back to previous selections.

Figure 40. Navigating in Kedit

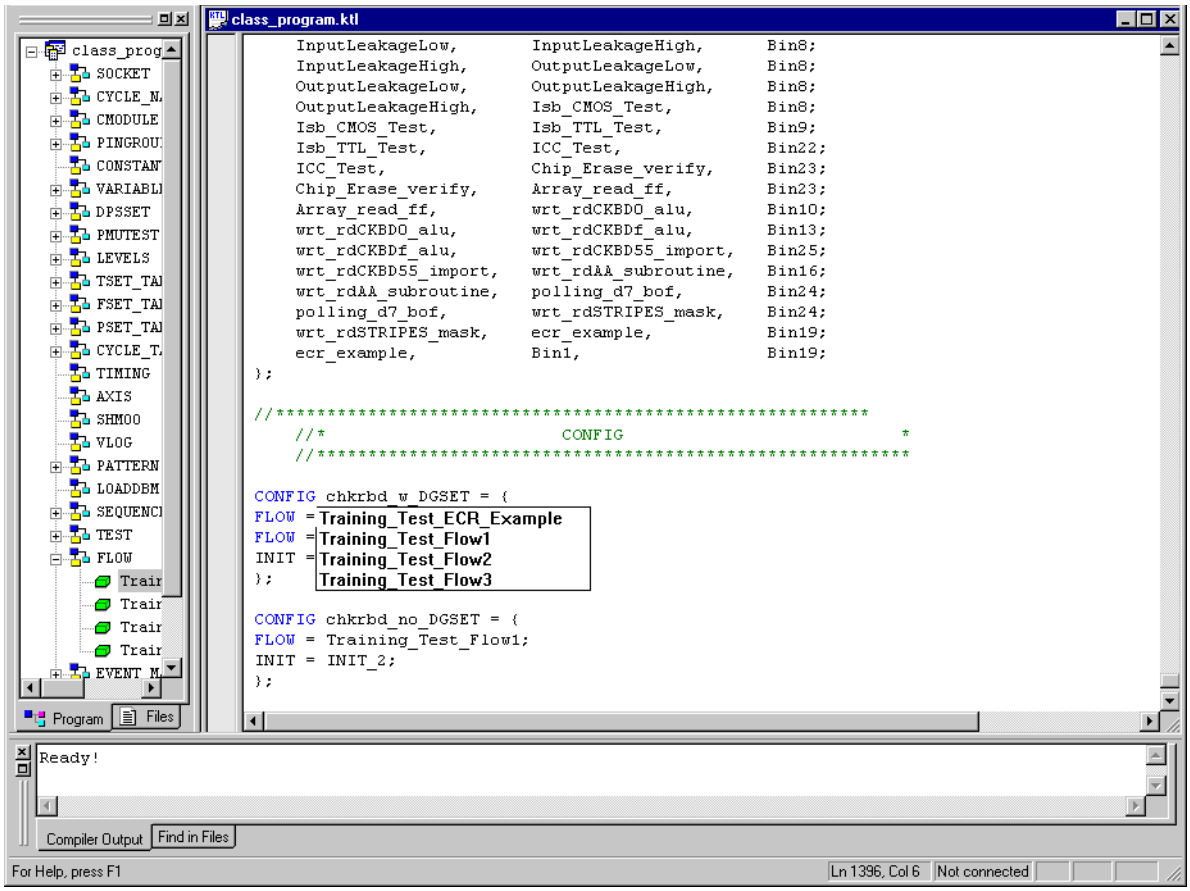


The Cut, Copy, and Paste options are like other text editor options. The Cut and Copy selections become active only when text is selected (highlighted). The Paste selection will paste whatever is in the clipboard at the insertion point (cursor position).

The Resource Completion feature allows the user to see existing resources, e.g., CONFIGs: FLOW, etc. For example, as shown in Figure 41, by typing in FLOW=, the existing flows appear in a pop-up that can be entered by selecting the desired option.

NOTE — This feature is activated only for test programs opened as a workspace.

Figure 41. View Existing FLOW Files



When defining a TEST resource, the SEQUENCE keyword followed by “=” and “{” brings up a menu of the following resource types:

PMUTEST

PATTERN

LEVELS

DPSSET

CYCLE_TABLE

SEQUENCE

VLOG

CHOOK

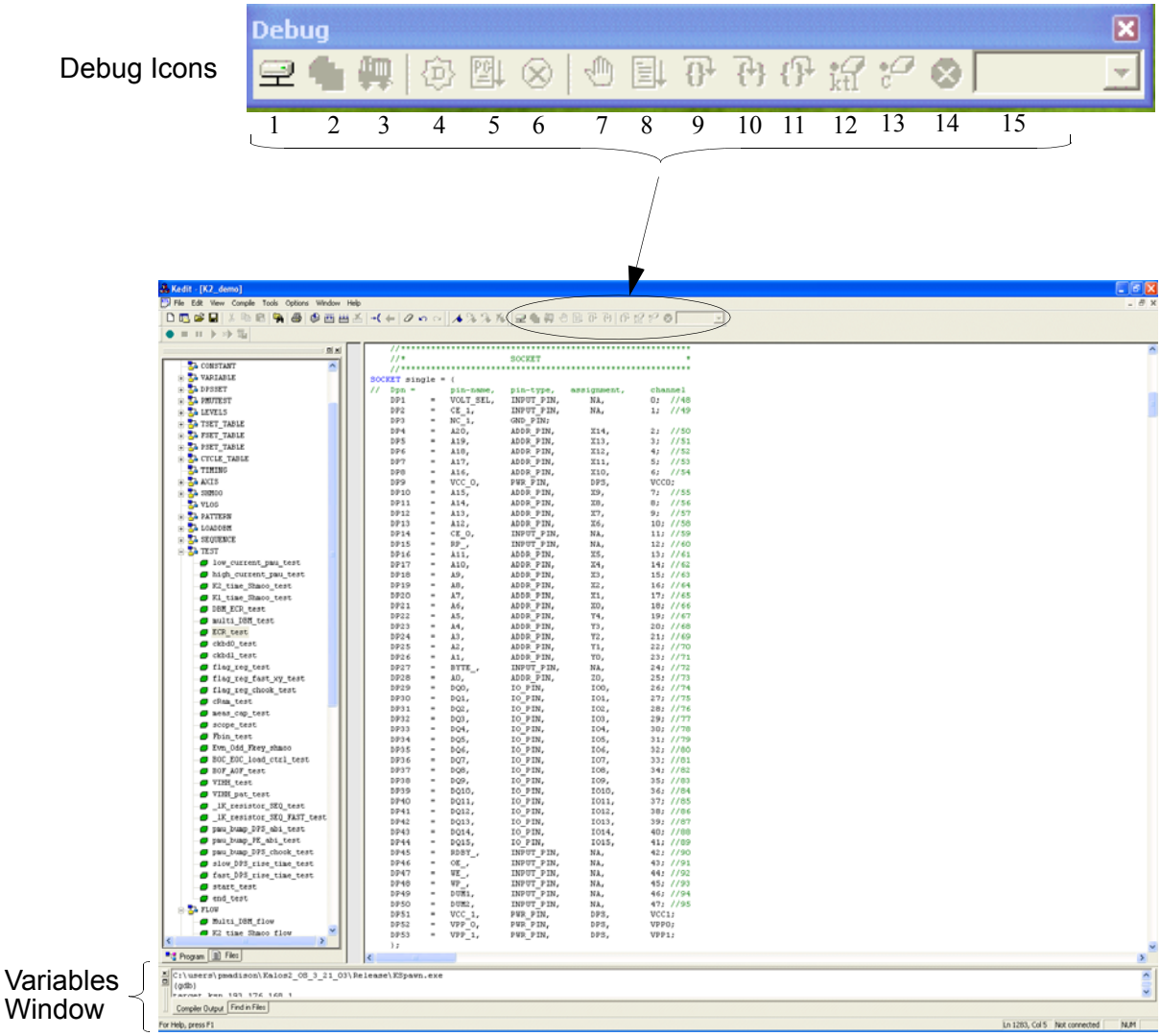
EDGESET

Select one of these resource types with a single mouse click or the Enter key. A list box of names with that resource type is then displayed. Use the Enter key, or double click the mouse to add the selected resource symbol to the test sequence. When a comma is entered, the list of resource types is displayed again.

Debugging Using Kedit

Debugging operations are available when using the Kedit utility, as shown in Figure 42. The Debug tool icons perform debug operations such as setting or clearing breakpoints, and controlling the flow of execution through the test program.

Figure 42. Debugging in Kedit



Debug Tools

The following is a functional description of each Debug tool (icon) on the Kedit toolbar, shown in Figure 42.

1. **Online/Offline** - Online mode enables debugging through Kedit. Offline mode enables test program modification and compiling.
   Note: The program cannot be modified from the online mode.
2. **Load Project** - After selecting a slice, load the Kalos 2 project file.
3. **Load Program** - After selecting a slice, load the Kalos 2 test program.
4. **Start KPL Debug -** Enables debugging for the last loaded pattern.
5. **PG Run -** Allows the user to burst the last loaded pattern in debug mode.
6. **Stop PG -** Stops pattern burst in the debug mode.
7. **Insert/Remove Breakpoint** - Toggles breakpoint at the line where the cursor is positioned.
8. **Start/Continue Test** - Starts or resumes testing after a breakpoint.
9. **Step over** - Execute the test element at cursor location.
10. **Step into** - Execute the test element one level below cursor location.
11. **Step Out** - Execute until next test element one level above cursor location.
12. **Clear All KTL Breakpoints** - Remove breakpoints from all lines in test program.
13. **Clear All C Breakpoints** - Remove breakpoints from all lines in C file.
14. **Stop test** - Stops the test.
15. **List of active modules** - The first step in debugging is to select the Kalos 2 master slice where debugging is to occur.

Using Debug Tools

To debug a test program using Kedit debug tools, proceed through the following steps.

1. Compile the test program workspace.
2. Click the *Online/Offline* icon on the Debug toolbar.
3. Select the module to debug on from the *List of active modules* on the Debug toolbar.
4. Click the *Load Project* or *Load Program* icon on the Debug toolbar to load a .kpj or .ktl workspace.

5. Select the *Flow* to run from the variables window at the bottom of the Kedit window (see Figure 42).
6. In KTL, position the cursor on a line that contains a sequence action, a CONFIG, EVENT_MAP, or the *Flow* line to break on, and click the *Insert/Remove breakpoint* icon on the Debug toolbar to set the breakpoint. In C code, position the cursor on a valid line of C code and click the *Insert/Remove breakpoint* icon on the Debug toolbar to set the breakpoint?.
7. Click the *Start/Continue Test* icon on the Debug toolbar to begin testing. If the breakpoint is reached, where the flow stopped appears in the *Context* field of the variable window.
8. Use the *Step over* or *Step into* icon on the Debug toolbar to navigate to the next test in the flow, or to step into the test sequence of the current test.
9. When the *Step into* icon is clicked, the next sequence action to be executed is marked with a yellow arrow, under the Context field in the variables window. Whether the *Step into* or *Step over* icon is clicked, the current action is executed and the next action is displayed. The *Step Out* icon in the Debug toolbar executes the remaining sequence actions of the current test, and stops at the next test in the flow.

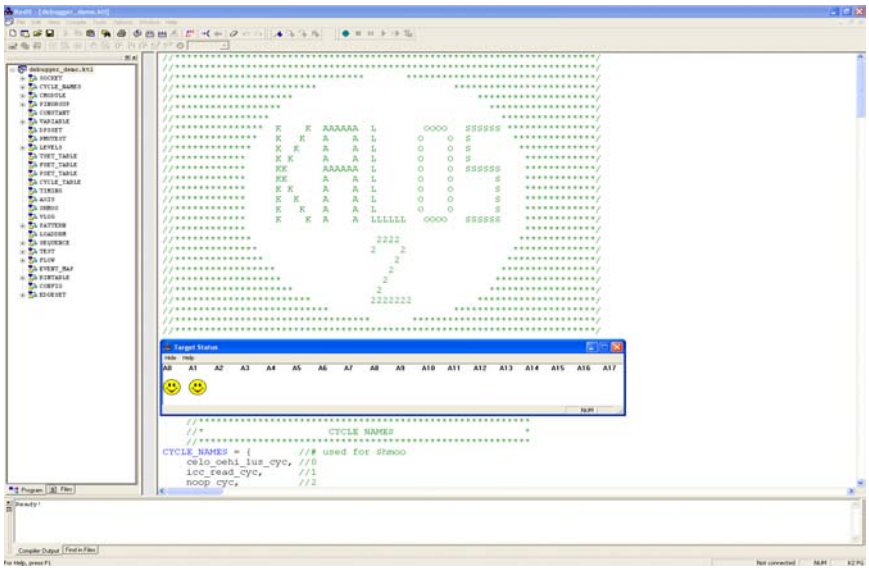
   For C code, use the Step over or Step into icon to execute to the next line of code. The Step out icon stops at the next line of calling function, or the next line in KTL code if the current function is a C-Hook called from KTL.
10. When the test program ends by binning out, the final results may be seen in the CView application.
11. Use the *Clear All KTL Breakpoints* or the *Clear All C Breakpoints* icon on the Debug toolbar to remove the breakpoints set in KTL or C code. Use the *Stop test* icon on the Debug toolbar to immediately stop testing.
12. To make modifications to the test program, first click the *Online/Offline* icon to go offline. Make program changes, compile, then begin with step 1 above.

Debugging KPL Source Code in Kedit

The history RAM can also be viewed from Kedit, which allows users to more easily debug patterns within a test program. Kedit can only launch the History Ram Control window once the debugging tools are launched.

Debugging tools that are launched from Kedit can debug C-source file code as well as pattern code within a KPL file. The tester must be powered on and the Target Manager launched and communicating with the tester in order to launch debugging tools in Kedit (see Figure 43).

Figure 43. Target Manager/Tester Communication

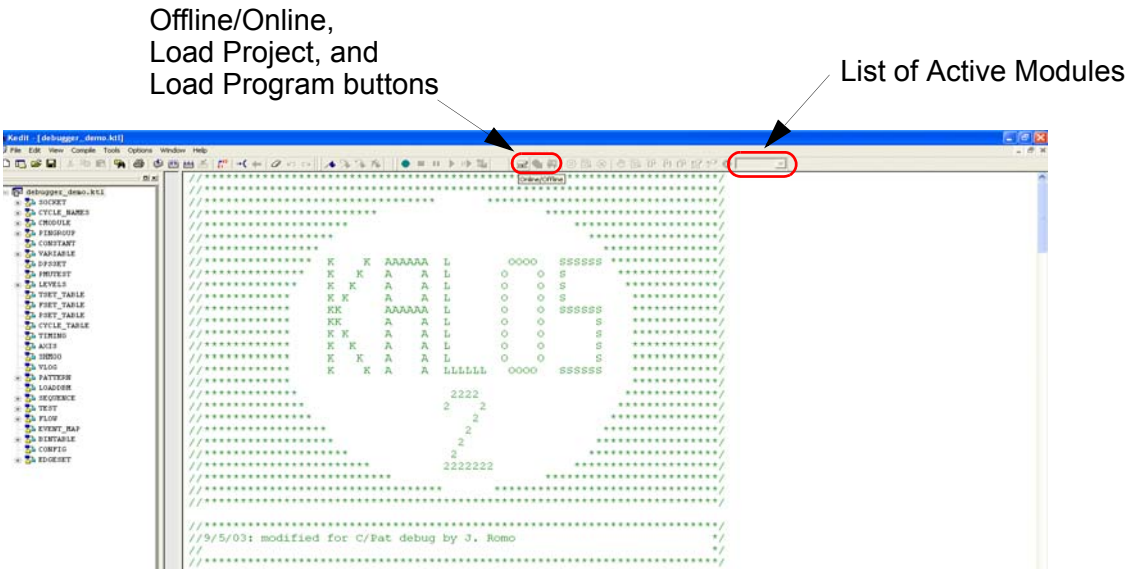


Although it is not necessary, launching the Front Panel and the Cview utility are helpful in allowing users to track tester functions and view results of the test program being debugged. The Datalog property page should be viewed by the user during the debugging.

NOTE — The Front Panel is used as a viewer only when debug tools in Kedit are in use.

Next, get the editor online using the online button on the Kedit toolbar, as shown in Figure 44.

Figure 44. Online/Load Buttons

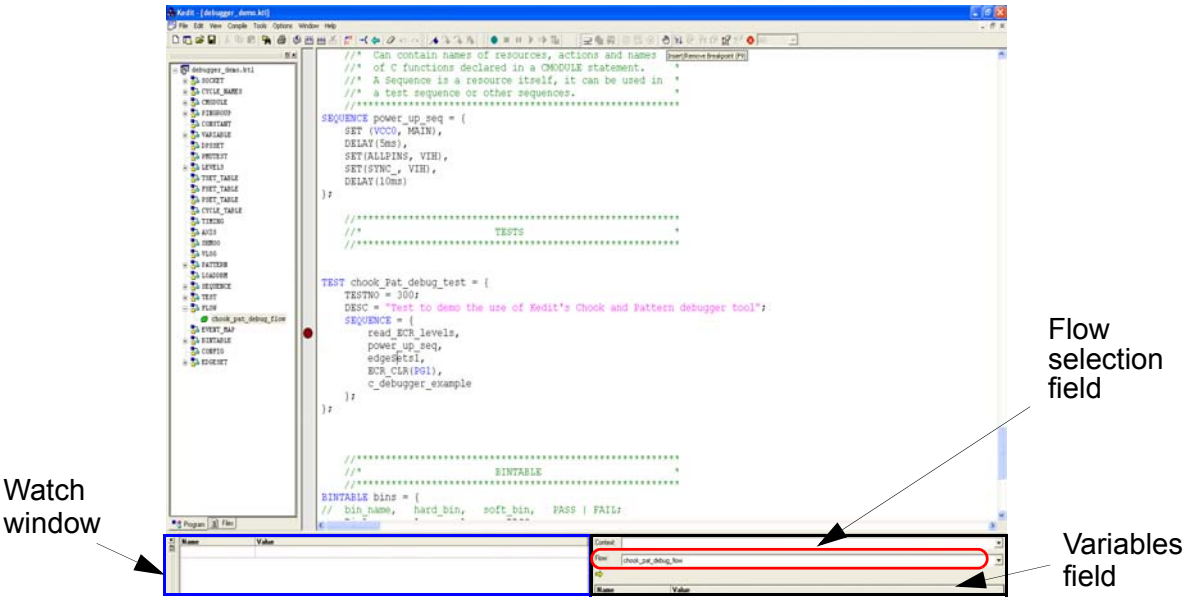


Once online, choose the slice that is to be debugged. Load the test program or project file that is to be debugged by pressing the load program (.kbi) or the load project (.kpj) button. Toolbar buttons, used to perform these functions, are described below:

- **Online/Offline** - Online mode enables debugging through Kedit. Offline enables test program modification and compiling.
- **Load Project** - After selecting a slice, this button loads a Kalos project file.
- **Load Program** - After selecting a slice, this button loads a Kalos program file.
- **List of Active Modules** - This button enables users to select the Kalos slice for debugging.

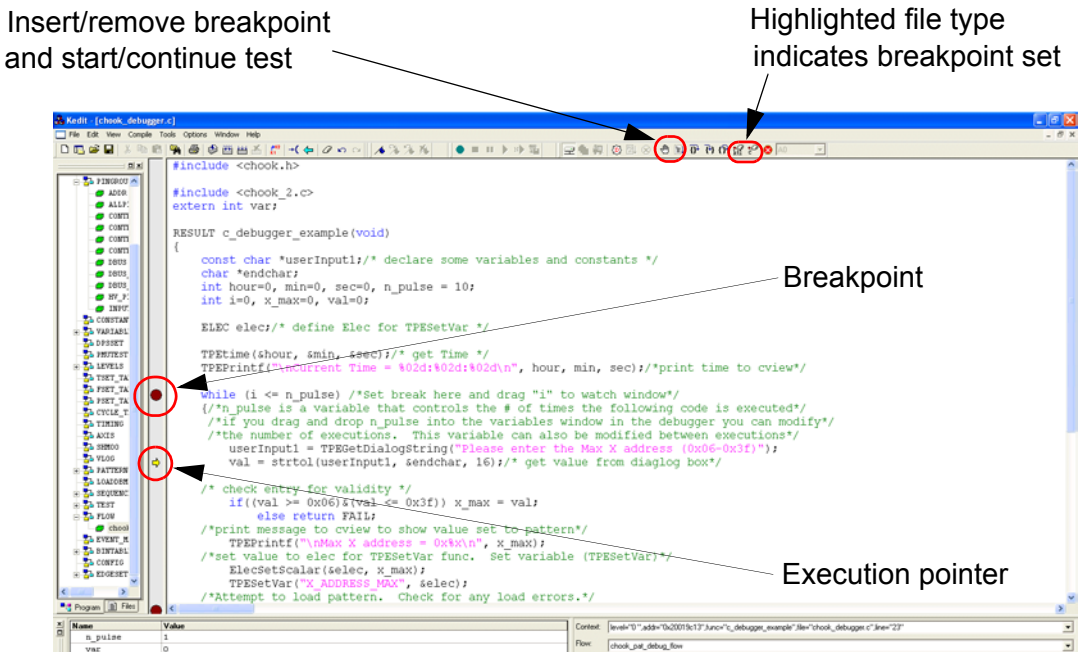
Choose the flow that is to be debugged in the loaded test program using the flow selection field shown in Figure 45.

Figure 45. Flow Selection



Once this is done users can set the breakpoints within the chosen flow, the tests within the flow, the sequences within the tests, the C-functions within the tests, or the load of a pattern within the tests. This is done by clicking on the insert/remove breakpoint button shown in Figure 46.

Figure 46. Breakpoint Settings



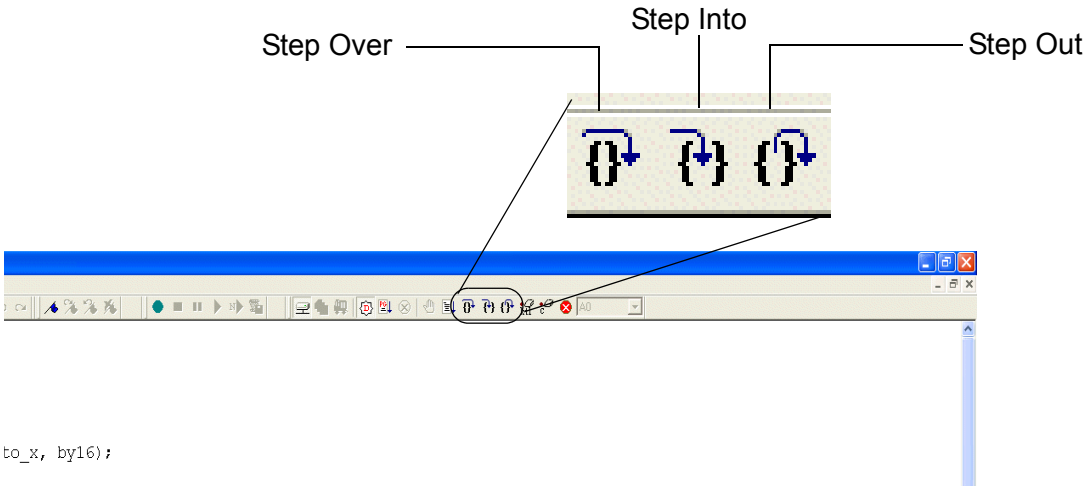
Once the breakpoints are set, the code within the flow of the loaded program is executed until it reaches the selected breakpoints. This is performed by clicking on the start/continue test button.

The file with the breakpoint set is highlighted on the toolbar. If both a C-source and a .ktl file have breakpoints set, then both file type indicator buttons are highlighted. Clicking on either of these buttons clears breakpoint settings for the respective file type.

Using the following *Step* options, shown in Figure 47, users can further control the execution of the code within the test program, during the current debugging session.

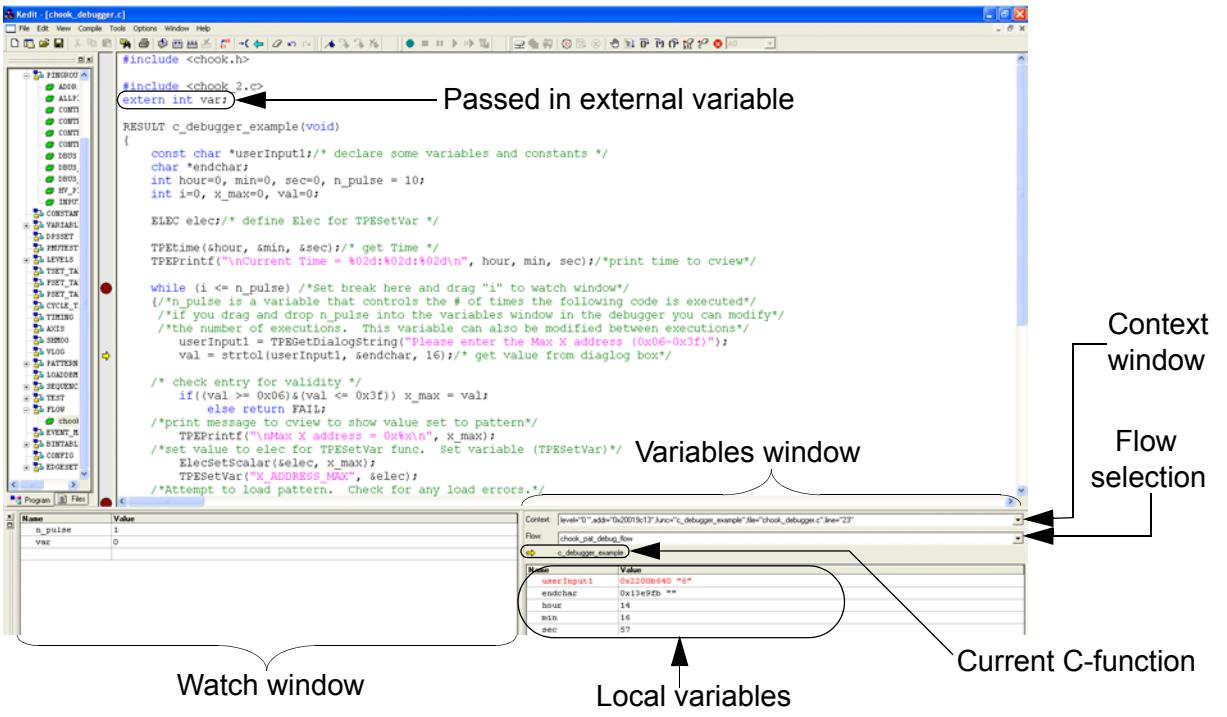
- **Step Over** - Allows the user to execute the source code at the location of the cursor.
- **Step into** - Allows the user to execute the source code one level below the cursor level (that is, step into a sequence that is within a test or step into pattern code from a pattern executed within a test or a sequence).
- **Step out** - Allows the user to execute the source code one level above the cursor level (that is, step out of a sequence that is within a test or step out of pattern code from a pattern executed within a test or a sequence).

Figure 47. Step Control of Execution



As shown in Figure 48, two windows appear at the bottom of Kedit. The watch window, which appears while debugging, allows users to monitor, watch, or edit global resources from within the C-source file or variables that are declared external variables, which are passed into the C-source file from other C-source files. This is accomplished by clicking on the selected variables and dragging them into the watch window.

Figure 48. Variables Selection



The variables window displays local variables (variables declared within a C-function). Within the variables window, users can select the flow to debug using the flow selection. This is performed first, or before executing code during the debug session. The variables window is a *view only* window. To edit these local variables, users must drag the selected variables into the watch window. The context window displays where you are in the debug session.

NOTE — As C-code executes, variables that have changed appear in red.

Variables declared with the *static* keyword will always have a value of 0. The value of static variables is hidden from the debugger.

The watch and variables windows are used to track the values of the variables used within the loaded C-source file. Any currently loaded pattern can be debugged using the KPL debugger.

From C-source files, use the applicable step button, located on the toolbar of the editor, to step to the line of code that will run the loaded test pattern. At this point, the *Start KPL Debug* button, located on the debug section of the toolbar (see Figure 49), will highlight. To start KPL debugging, click the *Start KPL Debugging* button. The source file of the currently loaded pattern is displayed and KPL debugging resources are enabled. Place the cursor on the first line of code in the pattern file. You will notice that there is now a new window loaded at the bottom of the editor (see Figure 50).

Figure 49. Start KPL Debugging

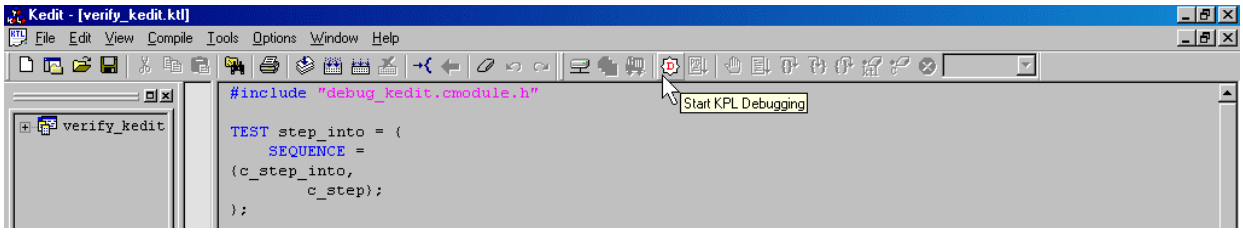
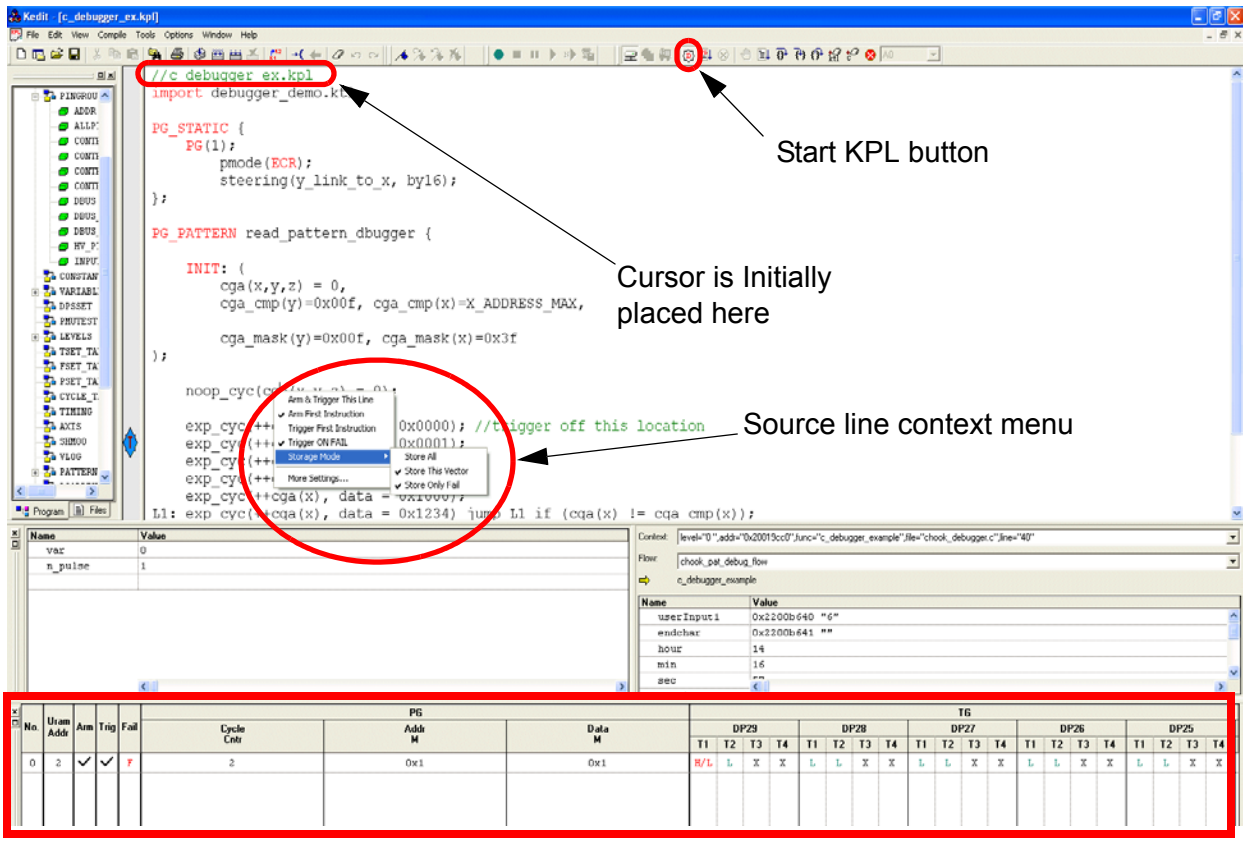


Figure 50. KPL Debugging Resources



The currently loaded pattern is debugged from a C-source file or from the loaded test program. Datalog, Pattern Generator (PG) and Timing Generator (TG) windows, at the bottom of the editor, allow users to vertically and horizontally scroll to view and select columns and menus to display the values of variables used within the test program or loaded C-source file.

Within a pattern file, users must set the arm and trigger to the required microram (URAM) location. This is set by clicking on the appropriate line of code. The context menu of a source line contains the following items:

- Arm & Trigger This Line
- Arm First Instruction
- Trigger First Instruction
- Trigger ON FAIL
- Storage Mode

As described in the History RAM Control section of the Introduction to KITE chapter, arm and trigger are two conditions that must be met either simultaneously or sequentially (first arm, then trigger) to start and stop storing data in history RAM N cycles later (see the number of cycles after arm & trigger conditions are met box in the History Ram Control dialog, shown in Figure 51). Some of the conditions that can be used to arm and trigger are:

1. Fail occurs
2. A URAM address is executed
3. Any counter reaches a condition value
4. Any combination of the above (logical AND combination)

Arming on the first cycle and triggering on fail is the commonly used setup for a datalogger.

Separate arm capability allows users to delay triggering to a URAM or cycle that occurs later during the burst, possibly after many other fails have occurred.

Arm & Trigger This Line	Sets Kedit to begin storing in history RAM at the current line and stop storing N cycles later by programming a value to the number of cycles after arm & trigger.
Arm First Instruction	Sets Kedit to begin storing in history RAM at the first instruction of the pattern.
Trigger First Instruction	Sets Kedit to pass N cycles, then stop storing in history RAM after the first instruction.
Trigger ON FAIL	Sets Kedit to pass N cycles, then stop storing in history RAM after the first fail occurs.
Storage Mode	Provides the following mode selections:

- Store All

  During each tester cycle, all of the PG/TG data for that cycle are stored until an arm and trigger occur, followed by the number of cycles specified in After Arm & Trig.

- Store This Vector

  This mode allows condition test cycles to be captured in the history RAM under the control of the URAM program or logic pattern. There is a *Store This Vector* (STV) bit in the URAM or LVM that causes data to be stored whenever that URAM is executed. This interactive debug feature (or advanced datalogger) modifies the URAM at debug time, allowing the user to examine the state of the PG/TG at various points in the program.

  Arming and triggering inhibit storing in this mode after N cycles that have the STV bit set.

- Store Only Fails

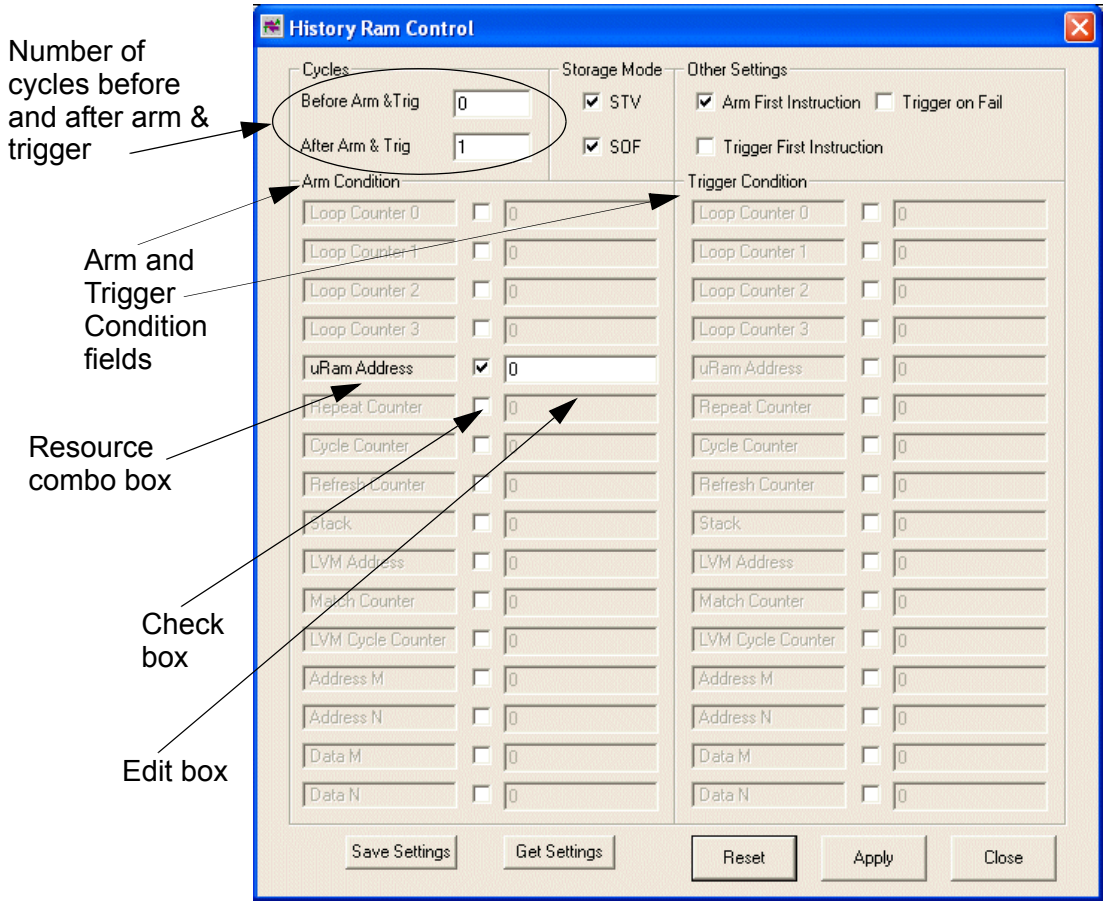
  In this mode only tester cycles with a strobe failure are stored. The history RAM can still be armed and triggered, however only data from fail cycles will exist in the history RAM at the end of test. This mode allows more fail data to be collected since passing cycles are not stored.

- Store This Vector and Store Fail Only

  This is the default mode for Kalos 2. This is a hybrid mode that stores fails on the tagged vectors/cycles only. To facilitate its use, all logic vectors set *stv* as do all algorithmic pattern instructions, except conditional fail instructions. Conditional fail instructions are those which jump, increment, or call a subroutine based on whether or not a fail occurs in the kpl. In this mode, it is likely that the user will arm and trigger on first fail since this is the objective of this default.

The History Ram Control window, shown in Figure 51, allows users to set any combination of arm and trigger conditions, as well as the number of cycles before and after arm & trigger conditions are met.

Figure 51. Arm And Trigger Conditions



The Before Arm & Trig edit box allows users to specify how many cycles to retrieve prior to the arm and trigger event. The After Arm & Trig edit box allows users to specify N, that is, the number of cycles to be stored in the History RAM once the arm and trigger conditions are met. A valid number is from 0 to 63. The sum of cycles before and after arm & trigger cannot exceed 64.

The *Arm Condition* and *Trigger Condition* fields contain arm/trigger conditions.

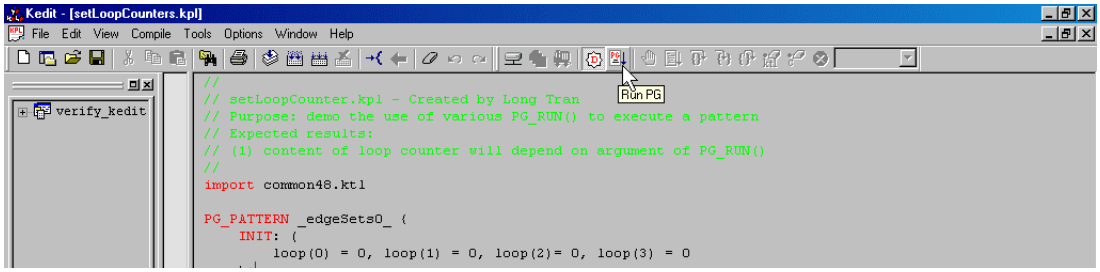
A definition of each condition (box), shown in Figure 51, follows:

- Cycles - Set number of cycles before and after trigger conditions are met
- Storage Mode - Specify storage condition (i.e., store all, store this vector, store only fails, store this vector and store fail only).
- Other Settings - Arm and trigger instructions
- Resource combo box - Contains the selection list of available resources
- Check box - Checked/unchecked (enable/disable) corresponding condition

- Edit box - Specify the value of the selected resource to match during the test to generate arm/trigger events
- Save Settings - Save the current settings
- Get Settings - Restore the previous settings
- Reset - Reset to Kalos software defaults:
  - select SOF and STV
  - cycles before arm & trigger set to 0
  - cycles after arm & trigger set to 1
  - arm first instruction selected
  - arm URAM address 0 selected
- Apply - Apply current settings to active targets
- Close - Close the History Ram Control application

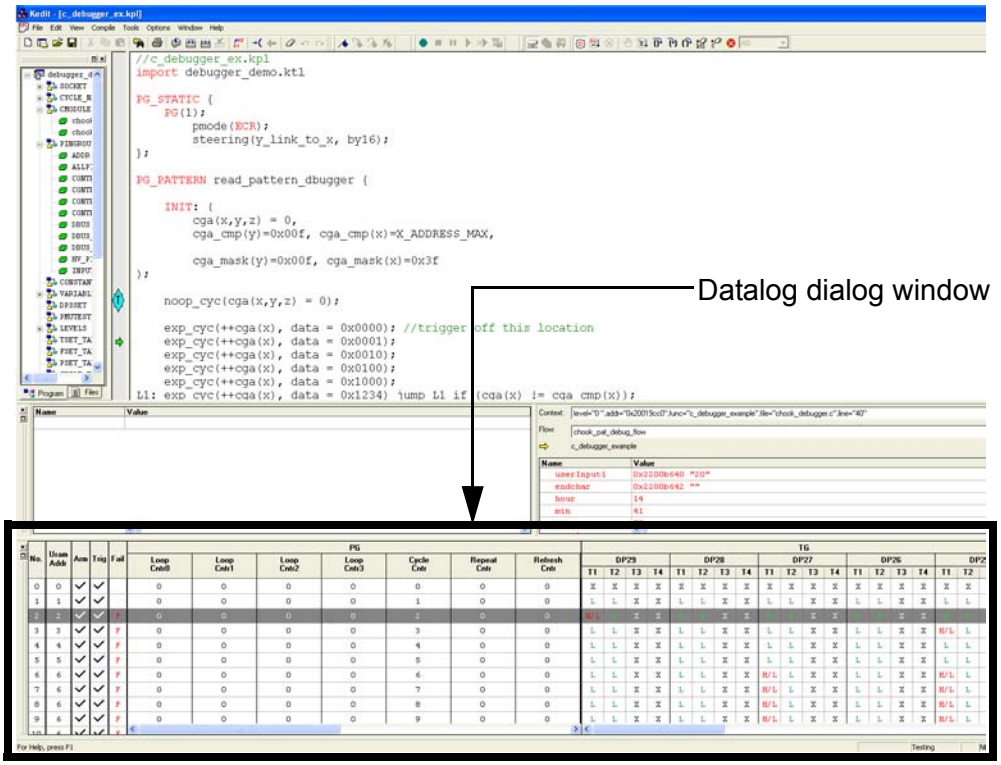
After setting arm/trigger conditions and storage modes, perform a pattern burst by clicking the Run PG button on the debug section of the toolbar (see Figure 52).

Figure 52. Run PG Button


Kedit - [setLoopCounters.kpl]
File Edit View Compile Tools Options Window Help
Run PG
verify_kedit
//
// setLoopCounter.kpl - Created by Long Tran
// Purpose: demo the use of various PG_RUN() to execute a pattern
// Expected results:
// (1) content of loop counter will depend on argument of PG_RUN()
//
import common48.ktl
PG_PATTERN _edgeSets0_ {
INIT: {
loop(0) = 0, loop(1) = 0, loop(2)= 0, loop(3) = 0

After the pattern burst, datalog results (captured under the specified storage conditions) are displayed in the *datalog dialog* window at the bottom of Kedit (see Figure 53) and on the Front Panel Datalog property page.

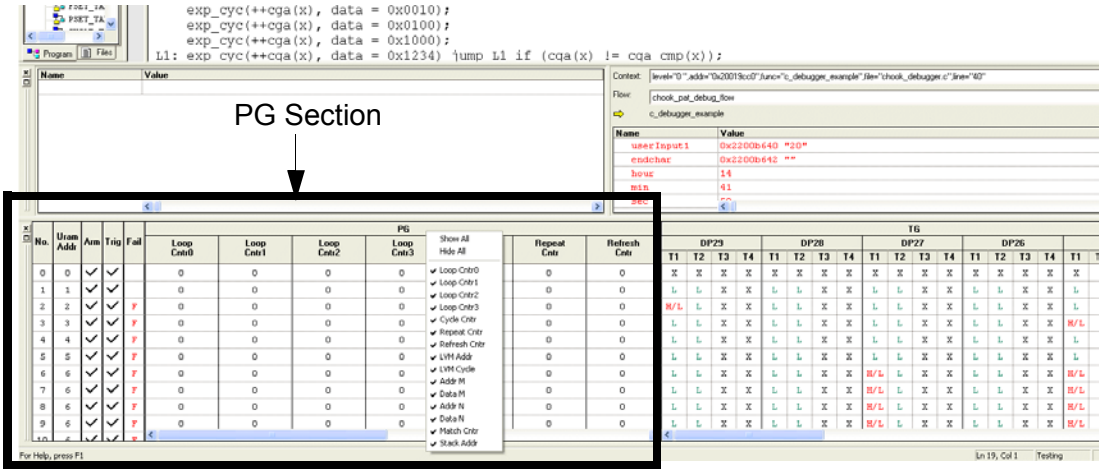
Figure 53. Datalog Dialog Window



NOTE — Users can manually bring up the datalog dialog window by selecting View => Datalog Dialog from the menu bar.

The PG section allows users to call up resources from within the pattern generator. By default, all possible resources (loop counters, cycle counters, address generator, data generators, etc.) are displayed in a context menu by right mouse clicking on any line in the datalog dialog field, as shown in Figure 54. Select the desired resource to display the column of its value. However, users can choose between the resources to be viewed.

Figure 54. Resource Selection



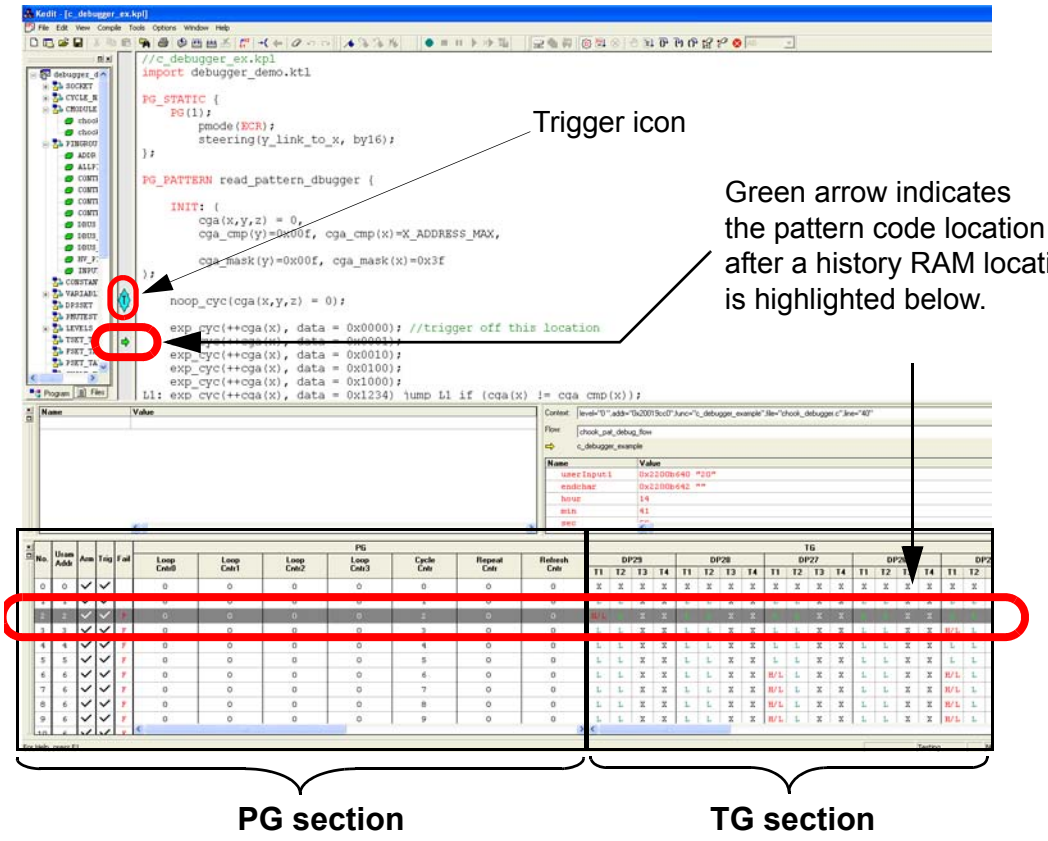
The following describes column items on the PG side of the datalog dialog window.

No.	History RAM (cycle) number - This number starts at 0 and displays the location of the data within the 64 deep history RAM. When *checked,* trigger and arm indicators within the pattern code reflect the chosen history RAm position (a green arrow inside the pattern source code).
Uram Address	Uram address number - This number displays the Uram address for the associated history RAM location.
Arm	Arm state - If checked, indicates the arm is set for this location of the history RAM.
Trigger	Trigger state - If checked, indicates the trigger is set for this location of the history RAM.
Fail -	Pass/Fail - A red *F* indicates a fail. An empty box indicates a pass.

NOTE — Saved data appears in the history RAM as soon as the pattern is armed and triggered.

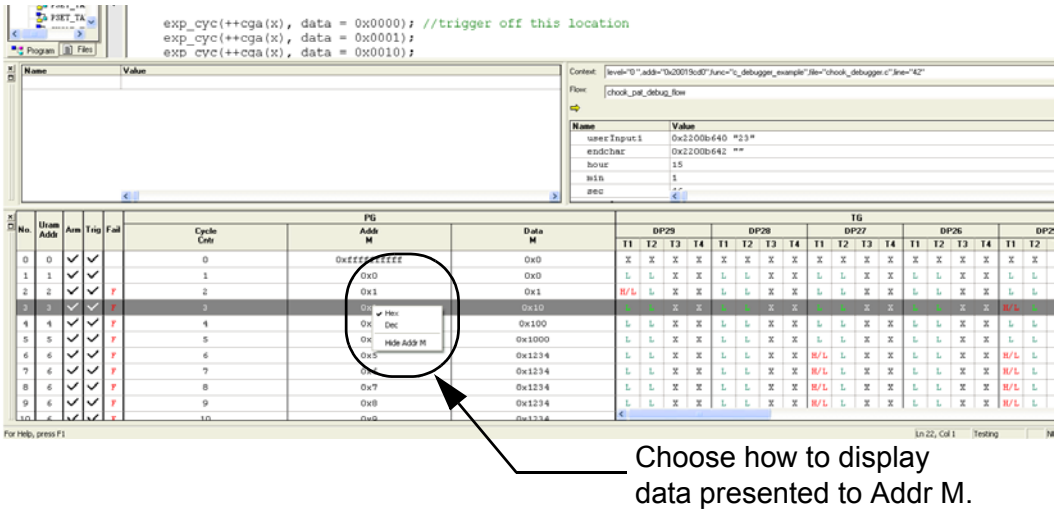
Double click on any line in the datalog dialog window to see the corresponding line in the source file of the pattern. A *green arrow*, shown in Figure 55, indicates that line in the source file. A trigger icon, a *T* within the symbol, indicates the line where the first arm and trigger occurred.

Figure 55. Source File Location


Trigger icon
Green arrow indicates the pattern code location after a history RAM location is highlighted below.
PG section
TG section

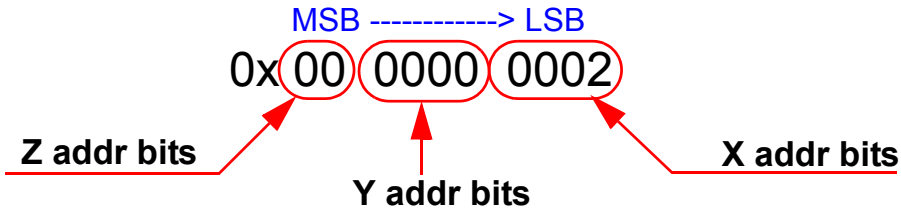
PG information displayed for the Addr M/N windows is the data presented to the address generator(s). As shown in Figure 56, counter group format can be displayed in decimal or hex. This is selectable by right mouse clicking on the address field.

Figure 56. Counter Group Format



If the data are displayed in a hex format, it has the least significant bit (LSB) on the left side and the most significant bit (MSB) on the right. The data in Figure 57 displays the bits combinations for the counter group in a hex format.

Figure 57. Data Display in Hex Format



NOTE — If in a decimal format, it is the decimal equivalent of the hex number.

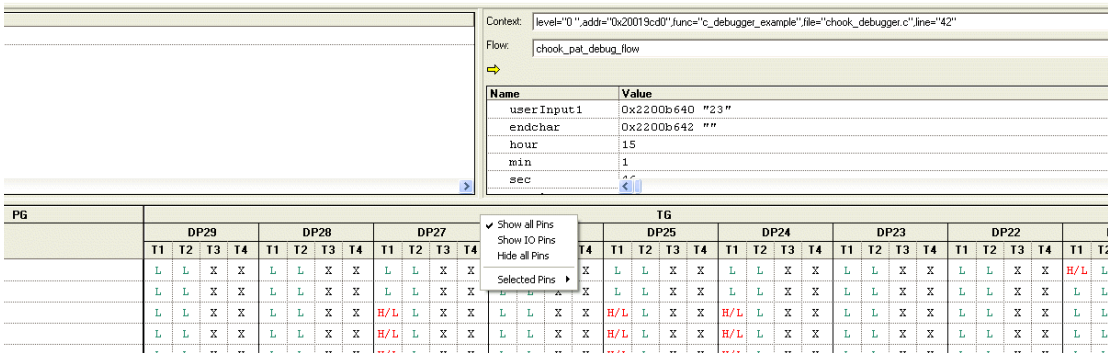
TG data stored in the timing generators, are listed by the pin ID information for I/O pins as it is listed on the socket table of the test program.

Users can right mouse click to view a pulldown menu that shows a pin options list (see Figure 58). Point to the *Selected Pins* option and select the desired pin from the pop-up context menu to display the column of its states. The selected pins are check marked.

The same context menu allows users to *Show all Pins*, or *Hide all Pins* at once, or *Show IO Pins* only.

Two modes are available for showing the states of pins: *Brief* and *Detail*. In Brief mode the cells of the TG field show only pass (P) or Fail (F) states. To switch the TG field to Detail mode, right mouse click on any cell and select *Detail* from the context menu.

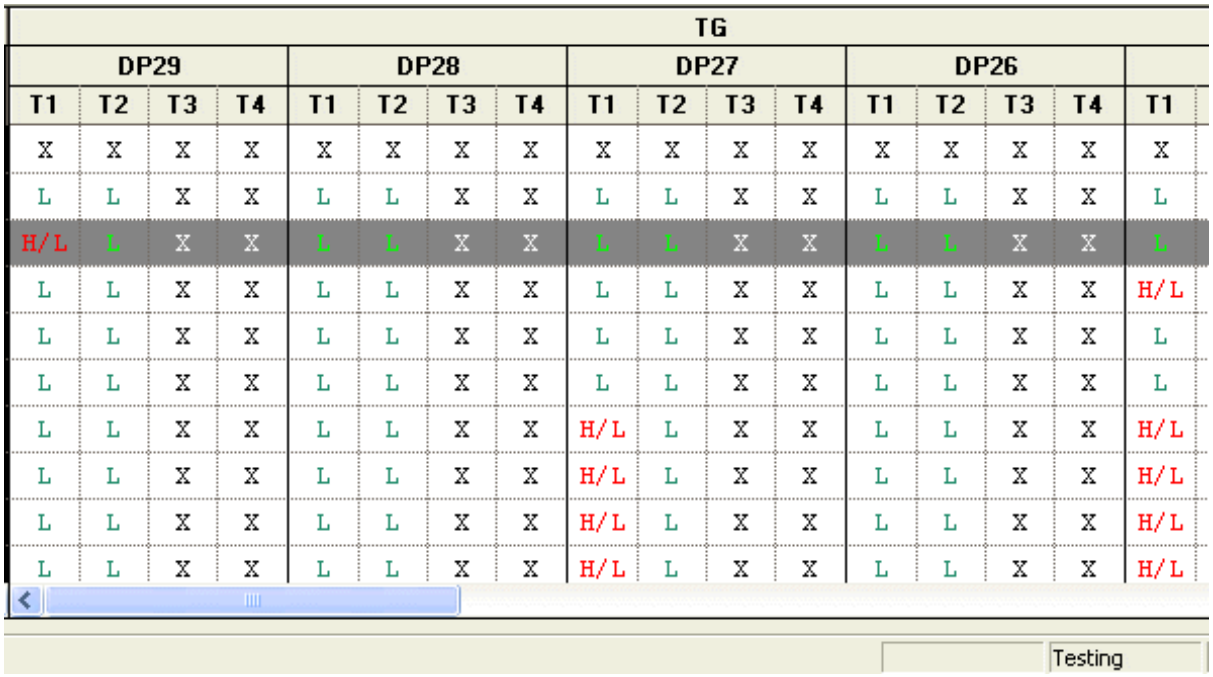
Figure 58. Pin Options Menu



Pins displayed in the TG window list pins from the least significant bit (LSB) (I/O 0) on the left side to the most significant bit (MSB) (I/O#) on the right side of the window. The data are further broken down to show all four timing edges for each of the pins listed. The following is a list of entries for each timing edge and their meanings (see Figure 59).

- **X** - Represents the data is *Don't Care* or that there was no programmed data for this pin edge.
- **L** - Indicates *pass* data if shown in the color green. Therefore, the format was an expect data low, which is the TG data.
- **H** - Indicates *pass* data if shown in the color green. Therefore, the format was an expect data high, which is the TG data.
- **H/L** - Indicates the expected format for the data was an expect high although the data retrieved from the device was low. This means the first entry is the expect data and the second entry is the actual data retrieved. This entry always appears in the color red, indicating a difference between the expect data and the actual data, or a failure for that particular device pin.
- **L/H** - Indicates the expected format for the data was an expect low although the data retrieved from the device was high. This means the first entry is the expect data and the second entry is the actual data retrieved. This entry always appears in the color red, indicating a difference between the expect data and the actual data, or a failure for that particular device pin.

Figure 59. Timing Edge Window



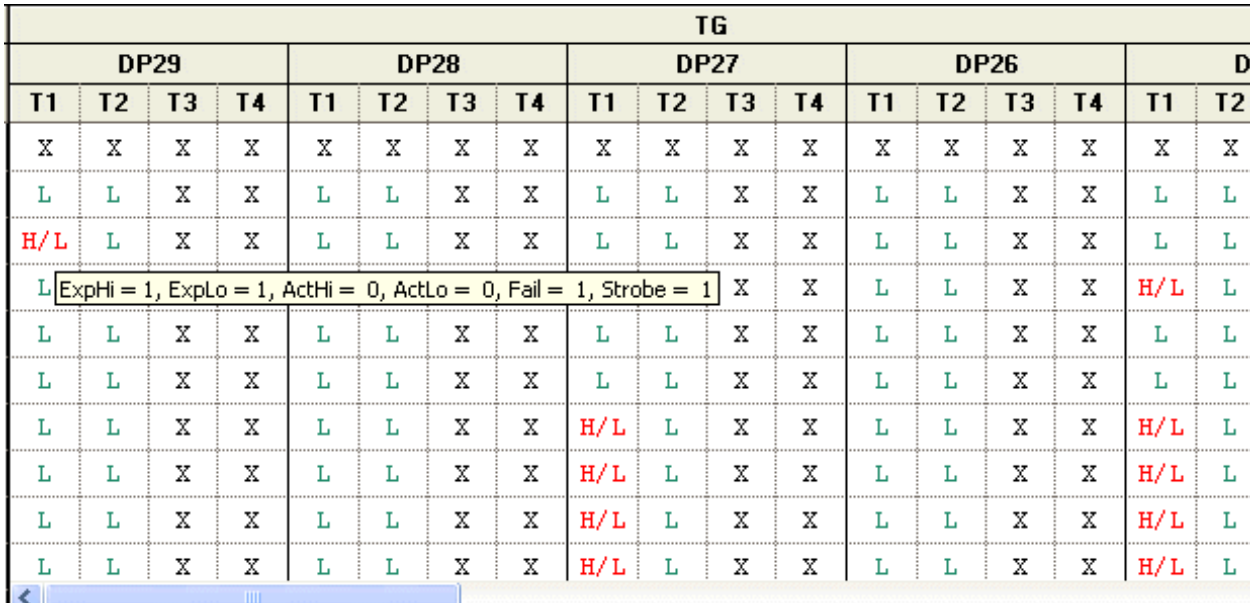
TG																
DP29				DP28				DP27				DP26				
T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L	L	X	X	L	L	X	X	L	L	X	X	L	L	X	X	L
H/L	L	X	X	L	L	X	X	L	L	X	X	L	L	X	X	L
L	L	X	X	L	L	X	X	L	L	X	X	L	L	X	X	H/L
L	L	X	X	L	L	X	X	L	L	X	X	L	L	X	X	L
L	L	X	X	L	L	X	X	L	L	X	X	L	L	X	X	L
L	L	X	X	L	L	X	X	H/L	L	X	X	L	L	X	X	H/L
L	L	X	X	L	L	X	X	H/L	L	X	X	L	L	X	X	H/L
L	L	X	X	L	L	X	X	H/L	L	X	X	L	L	X	X	H/L
L	L	X	X	L	L	X	X	H/L	L	X	X	L	L	X	X	H/L

Testing

When the cursor is placed over an edge, a window appears showing details of the expected, actual, failed, and strobe information (see Figure 60). Definitions and possible entries are shown in Figure 61.

NOTE — The data shown only appears for a couple seconds while the cursor remains over the edge. To redisplay the data, drag the cursor over to another edge then back to the original edge.

Figure 60. Timing Edge Details



TG																	
DP29				DP28				DP27				DP26				D	
T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L	L	X	X	L	L	X	X	L	L	X	X	L	L	X	X	L	L
H/L	L	X	X	L	L	X	X	L	L	X	X	L	L	X	X	L	L
L	ExpHi = 1, ExpLo = 1, ActHi = 0, ActLo = 0, Fail = 1, Strobe = 1									X	X	L	L	X	X	H/L	L
L	L	X	X	L	L	X	X	L	L	X	X	L	L	X	X	L	L
L	L	X	X	L	L	X	X	L	L	X	X	L	L	X	X	L	L
L	L	X	X	L	L	X	X	H/L	L	X	X	L	L	X	X	H/L	L
L	L	X	X	L	L	X	X	H/L	L	X	X	L	L	X	X	H/L	L
L	L	X	X	L	L	X	X	H/L	L	X	X	L	L	X	X	H/L	L
L	L	X	X	L	L	X	X	H/L	L	X	X	L	L	X	X	H/L	L

Figure 61. Timing Edge Definitions

Expected		Actual		Fail	Strobe	Mnemonic
Hi	Lo	Hi	Lo			
X	X	X	X	X	0	X
1	1	1	1	0	1	H
0	1	0	1	0	1	M
0	0	0	0	0	1	L
1	1	0	1	1	1	H/M
1	1	0	0	1	1	H/L
0	1	1	1	1	1	M/H
0	1	0	0	1	1	M/L
0	0	1	1	1	1	L/H
0	0	0	1	1	1	L/M
1	1	1	1	1	1	H/G
0	1	0	1	1	1	M/G
0	0	0	0	1	1	L/G

H (High) M (Midband) X (Don't Care)
L (Low) G (Glitch)

Once debugging of the pattern code is completed, click on the Start KPL Debugger button on the toolbar of Kedit. From this point debugging operations other than patterns, can be performed. If all debugging operations in Kedit are completed, click on the *Stop Test button*, on the toolbar, then click on the disconnect button. The Stop Test button stops the test and the disconnect button disconnects the debugger from the tester. This allows the Front Panel to control tester operations from that point.

4

INTRODUCTION TO KITE (KALOS 2 INTEGRATED TEST ENVIRONMENT)

This chapter provides an introduction to KITE software. It includes a description of the functions of the Front Panel. The Front Panel serves as a graphical front-end to load and control execution of test programs. An overview of each property page is provided, and how each property page relates to KITE tools and utilities is explained.

Instructions are provided on how to prepare a device for test, load a test program, and test the device once test system preparations are completed. Topics include:

- Test Preparation
- Target Manager
- Loading the Test Program
- Front Panel Interface
- KITE Software
- Calibration and Diagnostics
- Device Testing Procedure

Description of KITE

KITE is a collection of software tools that aid the development of test programs for testing devices on a Kalos 2 memory test system. These tools are supplied on CD-ROM for installation and used in a Windows XP environment.

Although test programs are based on the ANSI-C language, their development using the tools of KITE should present no problems, even to users with limited C programming experience. All KITE functions are compatible with the ANSI-C language environment, and input files can be created with most text editors along with the tools provided.

The basic steps involved in creating a test program in KITE, as well as the resources required at each step, follow. Each step is discussed in greater detail later in the KITE Tools and Utilities chapter in this manual.

Test Preparation

To get the equipment at a Kalos 2 test system ready for a device test, you must fit a device test fixture with necessary components, mount it to a test head and, in most production runs, join it to a device handler or wafer prober. The device test fixture for a given device has power runs and signal paths designed for accuracy and minimal aberrations.

The combination of test head and device test fixture is usually set up for one of three testing modes: manual, device handler, or wafer prober. The major steps in test station preparation consist of mounting the appropriate device test fixture to the test head and, if called for, docking the combination to a handler or prober.

DUT Interface

The Kalos 2 system requires a device under test (DUT) interface board(s) specifically designed for the customer application. The available signals are:

- Tester signal pins
- DPS force and sense lines
- Analog ground = AGND
- Analog ground reference = DZ
- Digital = DGT
- Available load board supplies

Test Fixtures

The Kalos 2 has available a variety of optional test fixtures. These include calibration and verification fixtures, DUT interface boards for both prober and handler type testers, and utility bits.

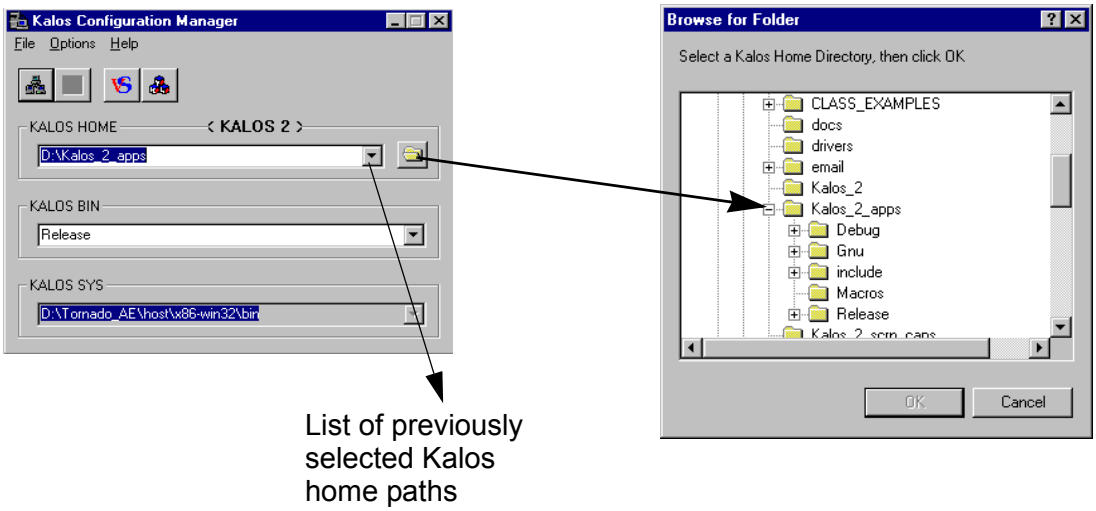
Configuration Manager

The Kalos Configuration manager is loaded separately from the standard Kalos KITE software. This manager allows the user to load more than one version of Kalos KITE software onto the computer, or access multi-version capabilities. To invoke the Kalos Configuration Manager, double click on the *Kalos Configuration Manager* icon (see Figure 62) located on the desktop or the task bar at the bottom of the desktop.

Figure 62. Kalos Configuration Manager

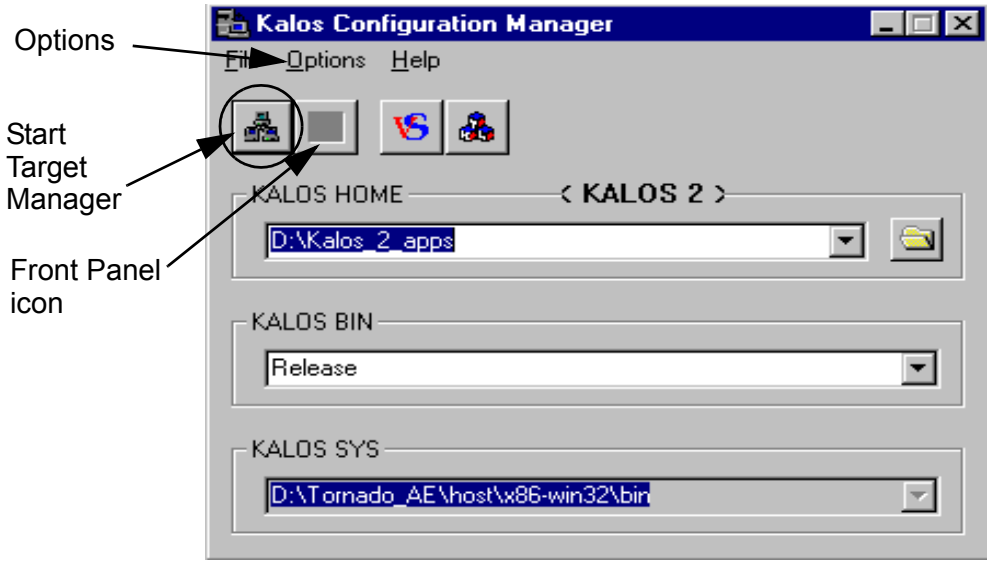
Once the Kalos Configuration Manager is launched, the user can choose the path to the version of software to be used during the current session. Click the down arrow to choose previously selected Kalos home paths. Add a new Kalos home path by clicking on the browse button and selecting the home directory from which to launch the Kalos software (see Figure 63).

Figure 63. Software Version Selection



Once the path to Kalos software is selected, click on the Target Manager icon (see Figure 64) to start the Target Manager. The Target Manager establishes connection with the target CPUs in the test head. Next, the Front Panel application can be launched, or a custom GUI application designed to perform Front Panel functions.

Figure 64. Start Target Manager



Choose the **Options** button on the menu bar to modify configuration options. A *Customize* options window is shown in Figure 65.

Select *Show Kalos Bin Directory* to display the KALOS BIN pane on the Configuration Manager window.

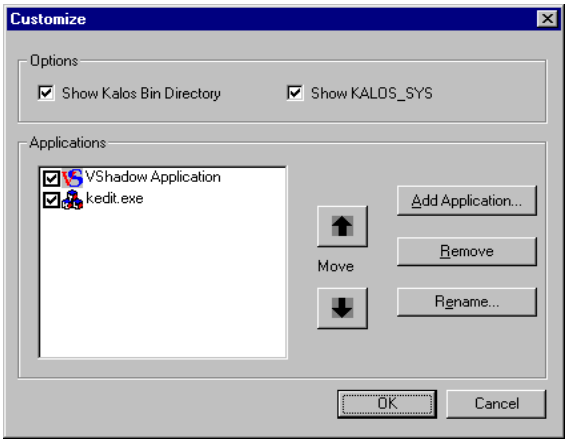
Select *Show KALOS_SYS* to display KALOS.SYS pane on the Configuration Manager window.

Add Application is used to select executable objects that are added to the applications list. Each checked application on the list has its icon displayed in the Configuration Manager window. Applications occurring within the Kalos bin directory are always matched with the selected Kalos home path. If ShowBitz is selected from a Kalos home path, then when the icon in the Configuration Manager view is clicked, the ShowBitz application will start from the currently selected Kalos home path and KALOS BIN directory.

Delete an entry from the applications list by first clicking on the name to select it, then click on the *Remove* button.

Rename an entry by clicking on the name to select it, then type in the name change and click on the *Rename* button.

Figure 65. Configuration Manager Options



Target Manager

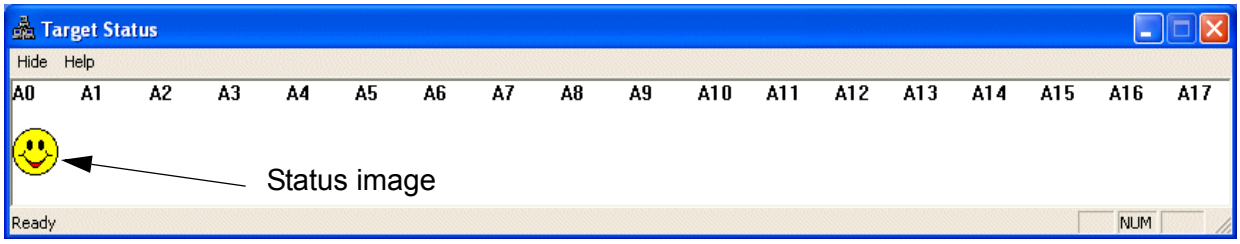
The Target Manager application is used to view the status of all boards in the test head. The Target Manager (TTarget) is responsible for establishing connection with the target CPUs in the test head. This is also the first application to enable interactive control of the test head from the host PC.

After TTarget is started, its icon (see Figure 67) appears in the task bar notification area (also know as the System Tray) found at the far right of the task bar. When the mouse hovers over this icon, the message "*Double-click TTarget icon to show Target Manager Viewer"* appears. Right mouse clicking on this icon displays the pop-up window shown in Figure 68. Doubling clicking on the TTarget icon in the System Tray or clicking the right mouse button and selecting *Show Targetmgr viewer* displays the Target Status window, shown in Figure 66.

Target Status

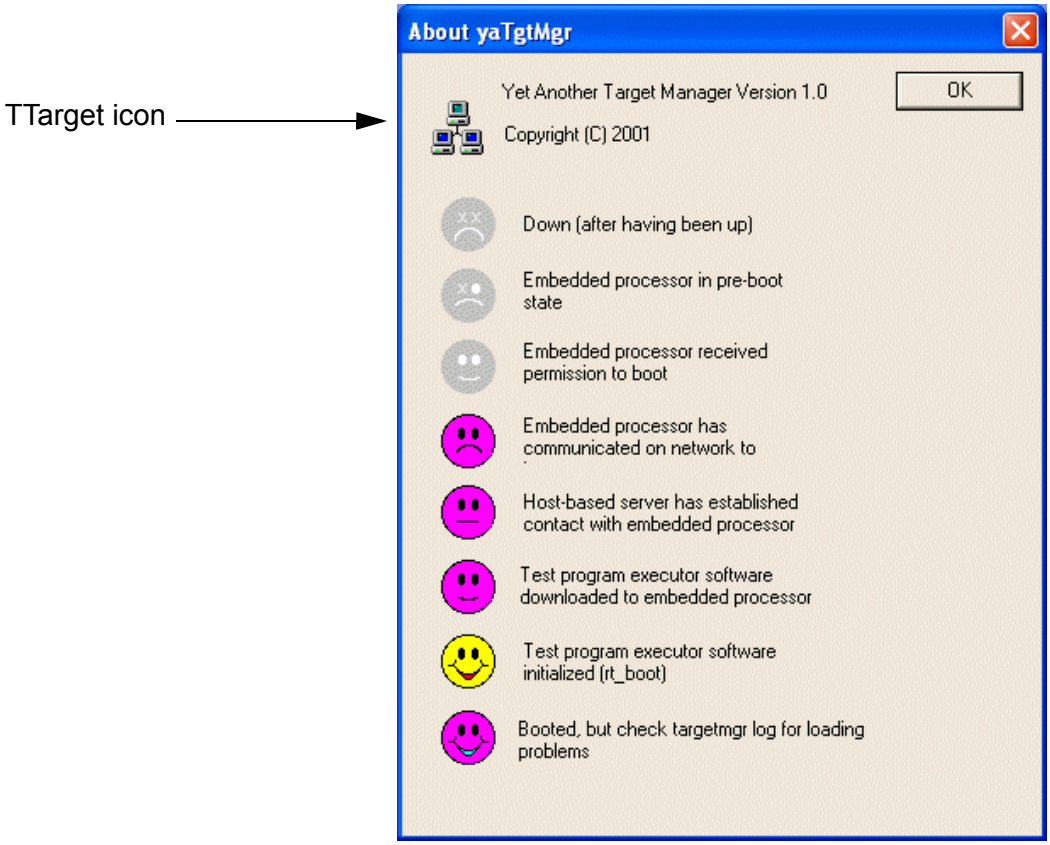
The Target Status window (see Figure 66) displays the 72 possible *targets* or Kalos 2 *slices*.These are further broken down into groups (A, B, C, and D), representing 18 slices each. Graphical images show the status of each slice.

Figure 66. Target Status Window



Clicking on the Help button displays all graphical images and provides a description for each (see Figure 67).

Figure 67. Target Status Image Descriptions


TTarget icon
About yaTgtMgr
Yet Another Target Manager Version 1.0
Copyright (C) 2001
OK
Down (after having been up)
Embedded processor in pre-boot state
Embedded processor received permission to boot
Embedded processor has communicated on network to
Host-based server has established contact with embedded processor
Test program executor software downloaded to embedded processor
Test program executor software initialized (rt_boot)
Booted, but check targetmgr log for loading problems

Show Target Manager Log

Click on the *Show / Hide targetmgr log* in the pop-up window, shown in Figure 68, to view or hide the Target Manager log. The Target Manager log shows logged information for connections to each target in the test head. This view provides detailed information that can be helpful when connection problems occur.

Figure 68. Target Icon Pop-up

Removing the Target Manager

To remove the target manager, right mouse click on either the target icon located at the bottom of your display or the pop-up menu in Figure 68.

Click on *Exit targetmgr and viewer* with the left mouse button. Users are then prompted to confirm the request, since the action closes the Font Panel application and terminates communication with the tester.

Loading Test Programs/Projects in KITE

Kalos test programs and projects are loaded onto the tester hardware through the Front Panel. The Front Panel serves as a graphical front-end to load and control execution of test programs/projects. Programs/projects are loaded by choosing one of the load options from the File pulldown menu, or by choosing one of the load button icons on the toolbar (see Figure 69).

This action invokes a browse window that allows the user to locate an existing test program/project file. Executable Kalos test programs have a .kbi extension. The Load Project Files (.kpj extension) option, like test program files, loads a *project* file. Double clicking on the selected file loads the program/project (.kbi or .kpj) file.

Another load option, Operator Interface, is a one stop selection with execution (load) that allows either program files or projects to be loaded with the following selected options:

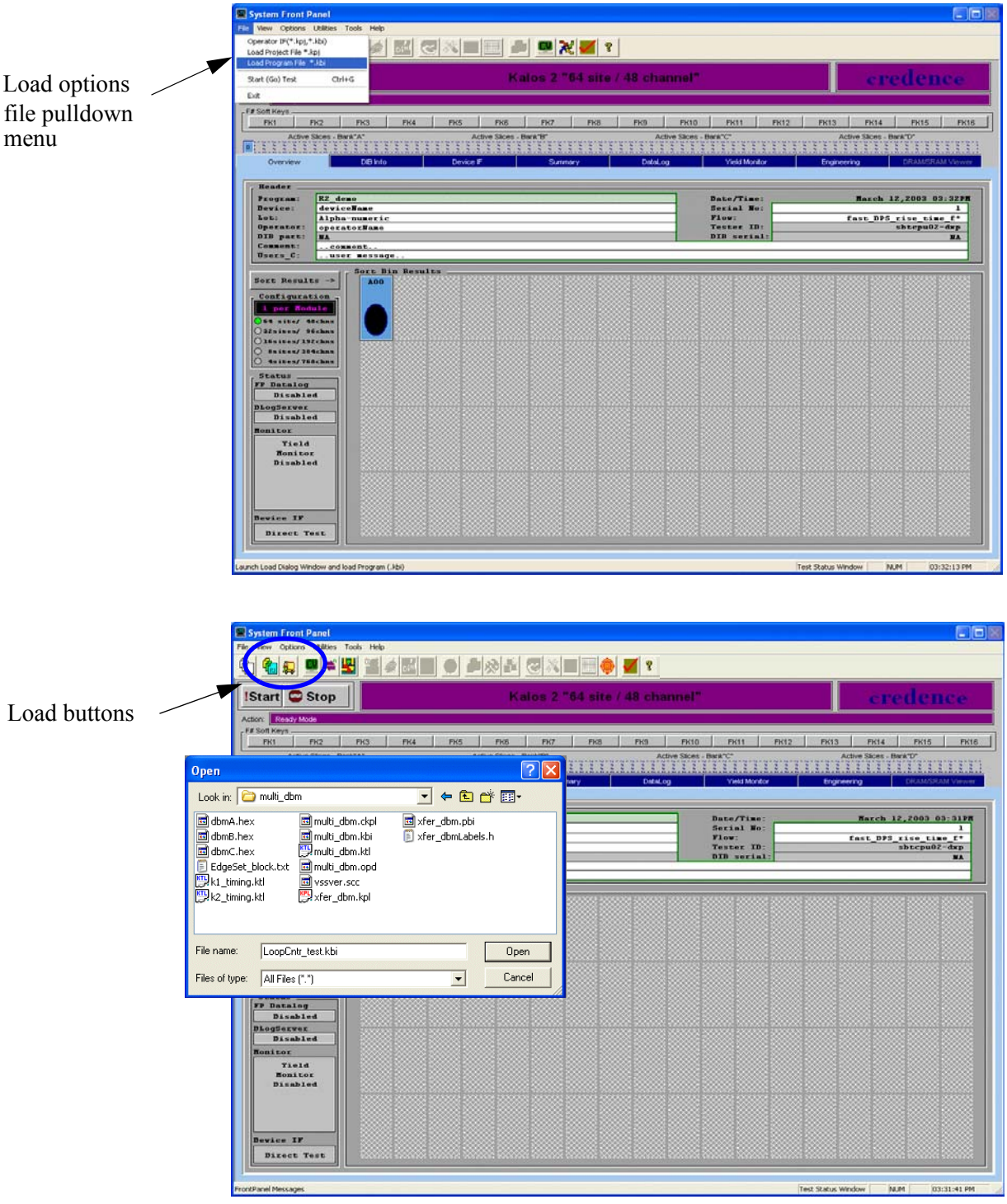
1. Auto-run DIB Cal
2. Datalog Engine
3. Sum Validation (16 or 32 code)
4. HEX file selection
5. Optional header entries

NOTE — Refer to the Device Testing Procedure section of this chapter for additional options when loading a project file.

Kalos Active Slices (Banks A, B, C, D) can be viewed on the Front Panel. The buttons below the text *Active Slices* correspond to the Kalos 2 boards found in the system. Banks corresponding to the slices physically attach to the various backplane boards in the test head. On a Kalos2 tester these begin with slice A0 (Bank A Slice 0) and display up to D71 (Bank D Slice 17).

Once a program is loaded, slices that have a valid program load appear blue. Invalid programs appear red.

Figure 69. Project/Program Loading



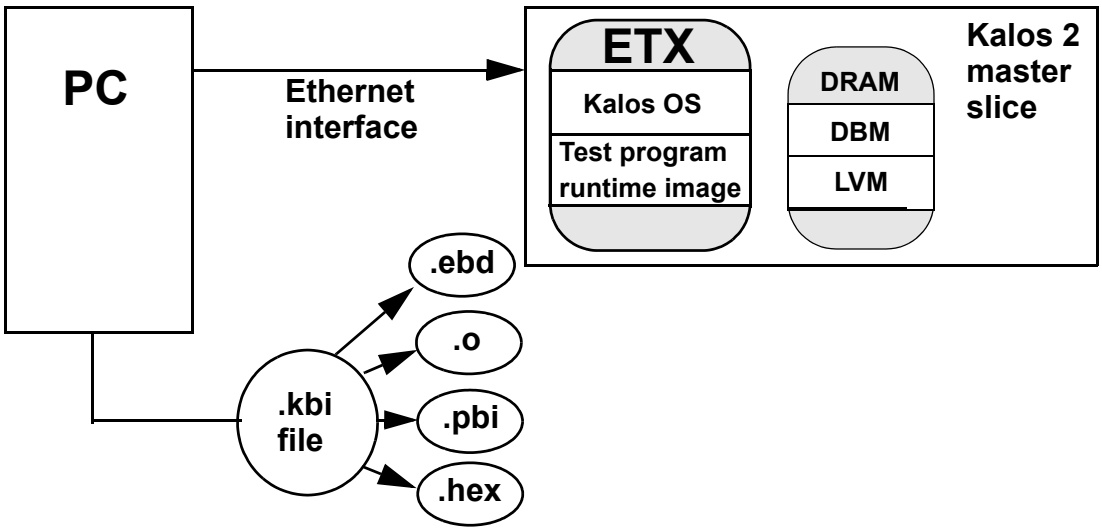
Test Program Load Setup

This section provides a basic overview of the Kalos 2 program load procedure. Embedded in the test program file are:

- All the information necessary to verify the test program matches the Kalos software used to load it.
- Tester configuration required by this test program.
- Names of all files required to be loaded on the Kalos 2 target processor in order for the test program to run.

All of the test program files that may be required by a particular test program are shown in Figure 70.

Figure 70. Test Program Load Process



The following sequence of actions take place at program load time. The types of files and related KTL resources involved at each step are noted. Each step is performed on all tester targets selected for the load program operation.

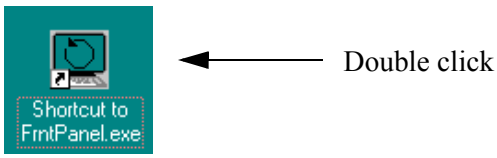
1. Delete current test program on target. The last loaded test program is deleted on the target in preparation for loading the next test program. As long as no configuration change occurs, such as going from a 48-channel to 96-channel DUT width, the contents of files previously loaded to the DRAM remain unchanged.
2. Unload CMODULEs or #clibrary files, C object modules with the extension .o, that were loaded for the previously loaded test program.
3. Process Kalos revision number, which terminates the load process if the test program is out of date with Kalos software being used to load it.

4. Process test configuration, which ensures the tester matches the DUT width of this program. Valid DUT widths are 48, 96, 192, 384, and 768.
5. Load the CMODULEs or #clibrary files, C object modules with the extension .o, defined in the test program.
6. Load the test program, which is a file name with a .kbi extension.
7. Load pattern files defined in the test program. Patterns are defined with the PATTERN resource keyword. The FILE parameter defines the pattern file name. Every pattern has a file name with .pbi extension. Patterns that contain LVM data also have a file name with an .ebd extension. The LVM data portion of the pattern is loaded into the DRAM on the target, as well as SRAM, which may be viewed in Front Panel from the DRAM/SRAM Viewer. If inadequate space exists to load a pattern, unused files in the DRAM are removed one at a time.
8. Load DBM files defined in the test program. DBM files are defined with the LOADBM resource keyword. The FILE parameter defines the DBM file name. DBM files have an .hex extension. At load time, the DBM file is converted to the Kalos binary format and loaded to the DRAM, as well as SRAM, on the target. If inadequate space exists to load a pattern, unused files in the DRAM are removed one at a time. The status of loaded DBM files may be viewed in Front Panel from the DRAM/SRAM Viewer.
9. If a Kalos Project file was loaded (file name with extension .kpj) and the associated config keyword defines a KTL CONFIG statement, the specified FLOW is selected on the target.
10. If a Kalos Project file was loaded (file name with extension .kpj) and the associated deviceif keyword defines a prober or handler DLL, the specified DLL is loaded on the Host PC.

NOTE — Test program loading will fail if the full path name of any loaded file exceeds 100 characters in length.

Front Panel Interface

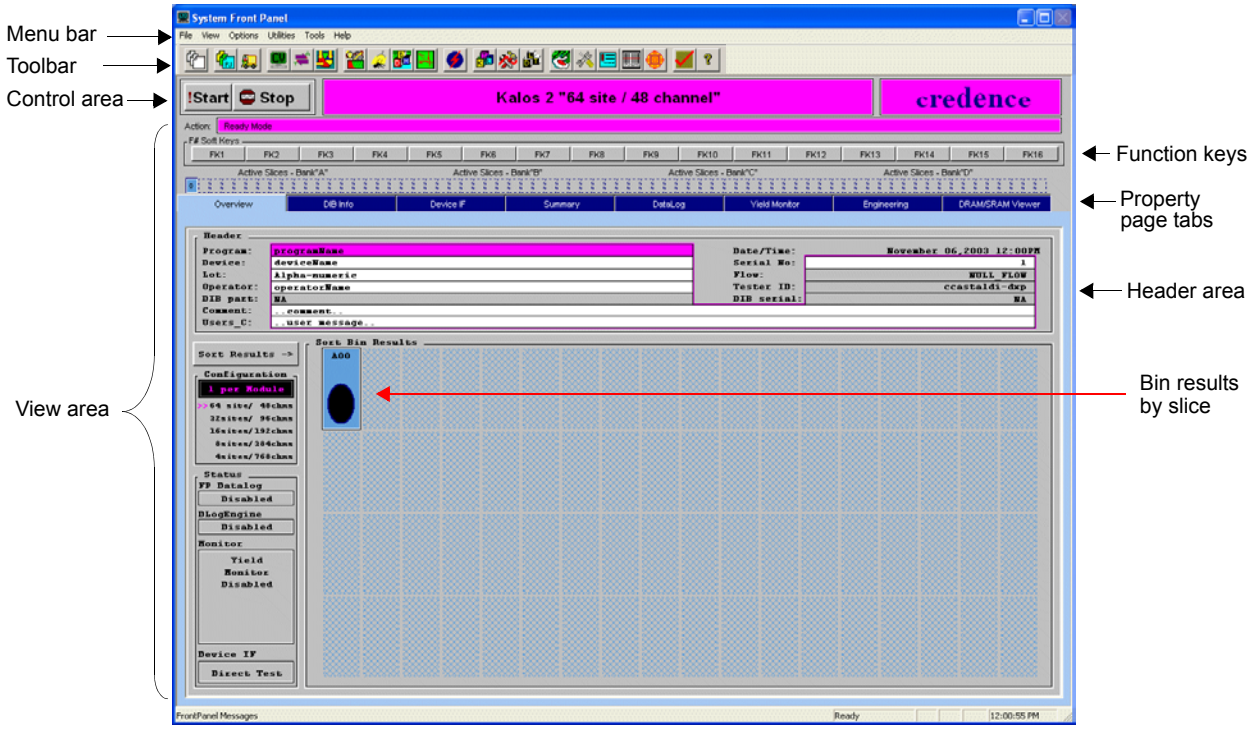
The System Front Panel is an interface between the Windows XP workstation and the Kalos 2 test system (see Figure 71). The Front Panel application is the main interface of KITE and serves as a viewer for directing, exploring, and altering environmental and operational functions. These functions include all normal operations required for the user to run a test program, including program management. The Front Panel is used to access the system diagnostic programs and the system calibration programs. To invoke the Front Panel graphical user interface (GUI), double click the *Front Panel* icon, *Shortcut to FrntPanel* icon located on the desktop, or through the Kalos Configuration Manager application.



The Front Panel provides the main user interface to the tester hardware. The System Front Panel application provides the setup functions for device testing. One of its functions includes loading of device programs. It is from Front Panel that test programs are loaded and executed, and that summary and datalog information are reported back to the user. These functions include all typical operations required for the user to run a test program and interpret the results.

NOTE — A password is required to enable Engineering application modes (non-production). Kalos 2 test systems are provided with a default password. This password appears in the Tester ID section of the Header panel on the Engineering property page.

Figure 71. System Front Panel Window (Default View)



NOTE — Slices can be activated or deactivated on the Overview and Engineering property pages.

KITE Software

The Kalos Integrated Test Environment (KITE) software provides access to development, debug, and diagnostic tools and utilities through a graphical user interface.

Starting KITE

The launching of KITE software is part of the start-up procedure for the Kalos 2 test system. The user must invoke the KITE software in order to launch the System Front Panel application or the Kalos 2 Configuration Manager. The default condition of the KITE application is the production environment from which Kalos test programs are loaded and executed. From Front Panel, all other applications, tools, and utilities can be launched. The menu bar and toolbar provide the mechanism for executing these other environments.

NOTE — Before re-starting KITE once the tester is running, ensure that all previous KITE windows are closed, then double click on the Front Panel icon.

Graphical User Interface

At start-up, KITE defaults to the main window of the System Front Panel application shown in Figure 71. This window is subdivided into the following defined operational areas:

- Menu bar
- Toolbar
- Control area
- View area

Menu Bar

The menu bar contains pulldown menu controls that include File, View, Utilities, Tools, and Help options.

The following table describes all areas of the menu bar.

Table 7. Front Panel Menu Bar Description

Option	Function
File	Clicking on the File option invokes the following list of selections:
Operator IF	The Operator IF option launches the operator IF window which provides the operators with a one page program loading interface.
Load Project File *.kpj	The Load Project File operation is used to load an executable Kalos 2 test project onto the tester hardware. Kalos 2 project files must include a .kpj extension.
Load Program File *.kbi	The Load Program File operation is used to load an executable Kalos 2 test program onto the tester hardware. It invokes a navigation window used for locating and selecting the desired test program file. Kalos 2 executable programs must include a .kbi extension.
Start (GO) Test	Allows the user to run the currently selected flow.
Exit	The Exit operation exits Front Panel and closes any open data files or associated programs.
View	View lists the following view option for Front Panel:
Pathnames...	Allows the user to see the pathname assignments selected for the program files.
Options	Clicking on options invokes the following selections:
Kalos 2 Sort Views	Expands the sort bin view to enable viewing of the bin numbers on a Kalos 2 tester.
PK2 Sort Views	Expands the sort bin view to enable viewing of the bin numbers on a PK2 tester.

Table 7. Front Panel Menu Bar Description *(Cont.)*

Option	Function
HistoryRam Datalog Formatting (KDatalog)	Allows users to monitor conditions of the pattern and timing generator at a set condition point within a functional test or a point within a patterns execution.
Utilities	Selection of the Utilities option invokes the following list of available KITE application utilities:
CVIEWER	The Console Viewer is a viewer for observing communication messages sent from the i960 of each Kalos 2 board to the workstation computer.
TBUGGER (Test Bugger)	This menu item activates the test debugger (Test Debugger) environment. This utility allows the user to modify resources for the current test program on the fly, without the need to re-compile.
KEDIT	Kedit, Kalos 2 (KTL) Editor, is a Credence supplied text editor.
WAVEFORM (AWT)	Analog Wavetool is a graphical tool used for manipulating waveforms.
LDTOOL	A front-end application intended for advanced debugging, editing, and running of test patterns, as well as viewing the results of running stored patterns in History RAM.
DBMEDIT	Data Buffer Memory (DBM) Editor allows the user to select a fixed or customized format for the graphical table views—Kalos 2 defined and/or user defined.
DLOGEngine (Datalog Engine)	Allows the user to launch the Datalog Engine (which gives the user access to the data stream).Note: No Dialog window is displayed. Visual confirmation is seen in the Front Panel *Overview* status or on the icon tray of the task bar.
CAL DIAG	Selection of the Cal/Diag menu item activates the KITE Calibration and Diagnostics environment.

Table 7. Front Panel Menu Bar Description *(Cont.)*

Option	Function
SHOW BITZ	Selection of the ShowBitz menu item activates the ShowBitz environment. This environment allows the user to interact with the Kalos 2 system hardware at a register level for debugging purposes. Refer to the Reference Manual located under the Help menu of the ShowBitz utility for additional information.
IDROM	Provides the user with non-volatile program memories information (Motherboard, PMU, DPS, DAC, SRAM slice, and ETX).
NVMDIB	The Non-Volatile Memory (NVM) on the Device Interface Board (DIB) is a small memory located on the test hardware that contains identification and configuration information needed by the test program.
SYSTEM MONITOR	Monitors the electrical state of the tester system in terms of voltage, current, and temperature readings.
MAP INIT	The MAP INIT selection brings up the MAP Initialization dialog box that allows the user to select all slice.
Tools	The Tools menu item includes the following KITE external support application tools:

Table 7. Front Panel Menu Bar Description *(Cont.)*

Option	Function
Shmoo, PMon VLog Bitmap	The Shmoo menu item launches the Shmoo Plot tool which supports 1, 2, and 3 dimensional shmoo plots. The Pin Monitor (PMon) allows the user to evaluate the performance of a DUT on a per pin basis. The evaluation is performed by creating one dimensional shmoo plots of each resource that is allocated to a pin. VLog (ValueLog) provides an AC datalogger. Two types of test execution are available: binary (search) or linear (sweep) test. Valuelog sequencer has a testing matrix for single (selected row) or flow testing (all rows). The Bitmap viewer displays current cell/address failures of the DUT. This includes two displays: MegaMap (compressed view) and Bitmap (uncompressed view).
BitPower	BitPower tool (optional application) allows the user to analyze failed bit information collected at wafer sort.
Help	The following items are provided under the Help menu:
About FrntPanel...	This menu item displays the current revision identification of the Kalos 2 software, as well as limited system software and hardware information.
Version Check (VCheck)	Informs the user of the available versions of Kalos software installed on the system.

Toolbar

The toolbar is an arrangement of graphical icon buttons, clustered in functional groups, that execute commands and invoke KITE software tools and utilities. These buttons provide quick access to the most commonly used commands of the pulldown menu bar.

The toolbar is located directly below the menu bar of the System Front Panel window.

Figure 72 shows the layout of the toolbar (in Engineering mode), and lists the commands executed for each toolbar button. KITE commands, tools, and utilities are invoked by a single click of the left mouse button.

When in Engineering application mode (non-production), all tools are displayed (enabled). When in production mode (see Figure 73) Shmoo Plot-PinMonitor-ValueLog, Test Bugger, DBM Editor, Bitmap, BitPower, Kalos Editor, Analog Waveform Editor, Kalos Logic Debug, ShowBitz, Cal/Diag, IDRom, and NVMDIB are disabled (grayed areas). Users must logon by way of the Front Panel's Engineering mode to enable these tools. Refer to Table 7 for a description of the toolbar items.

NOTE — Breaktrap setting and operations also require logon and password.

Figure 72. Front Panel Toolbar (Engineering Mode)

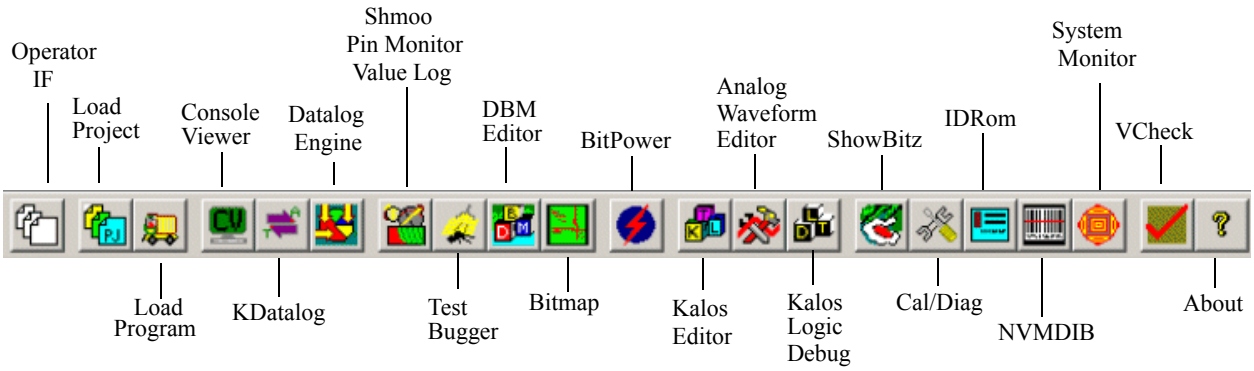
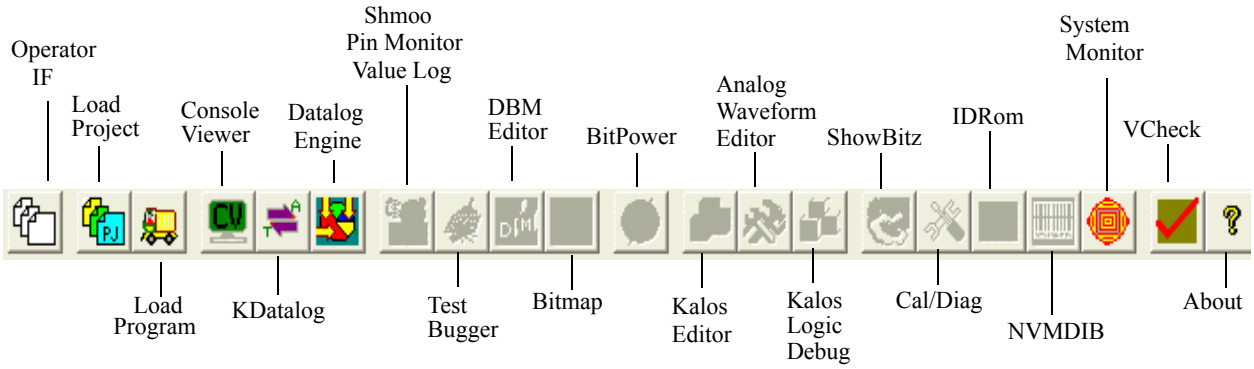


Figure 73. Front Panel Toolbar (Production Mode)



View Area

The view area of the Front Panel provides a selection of tabbed property pages with specific overviews of the Kalos 2 hardware and current test program. Selected information is displayed on each page. In addition to providing a viewer for specific functions, each property page allows for modification of components when the selected environment allows such changes. Information on active slices is also provided.

The selection of a property page is accomplished by moving the cursor over the desired tab and clicking the left mouse button (see Figure 74). This action selects the property page and brings it to the top of the stack for viewing.

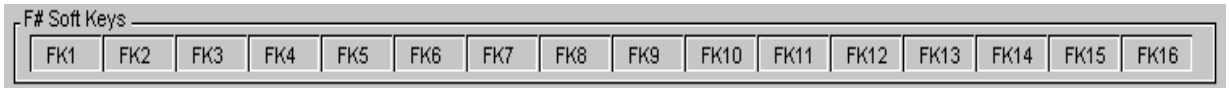
Figure 74. Property Page Tab Selection

The following subsections describe the Front Panel property pages.

Function Keys

There are 16 function keys (see Figure 75) that allow the user to activate certain sequences that are assigned for specific uses in the test program. To use the function keys, click on the appropriate function key. Functionality (program flow sequences) is program dependent. Any test sequence can include an *FKey (#, seq_name)* function. If the key number is active, the specified *seq_name* is executed.

Figure 75. Function Keys



Active Slices

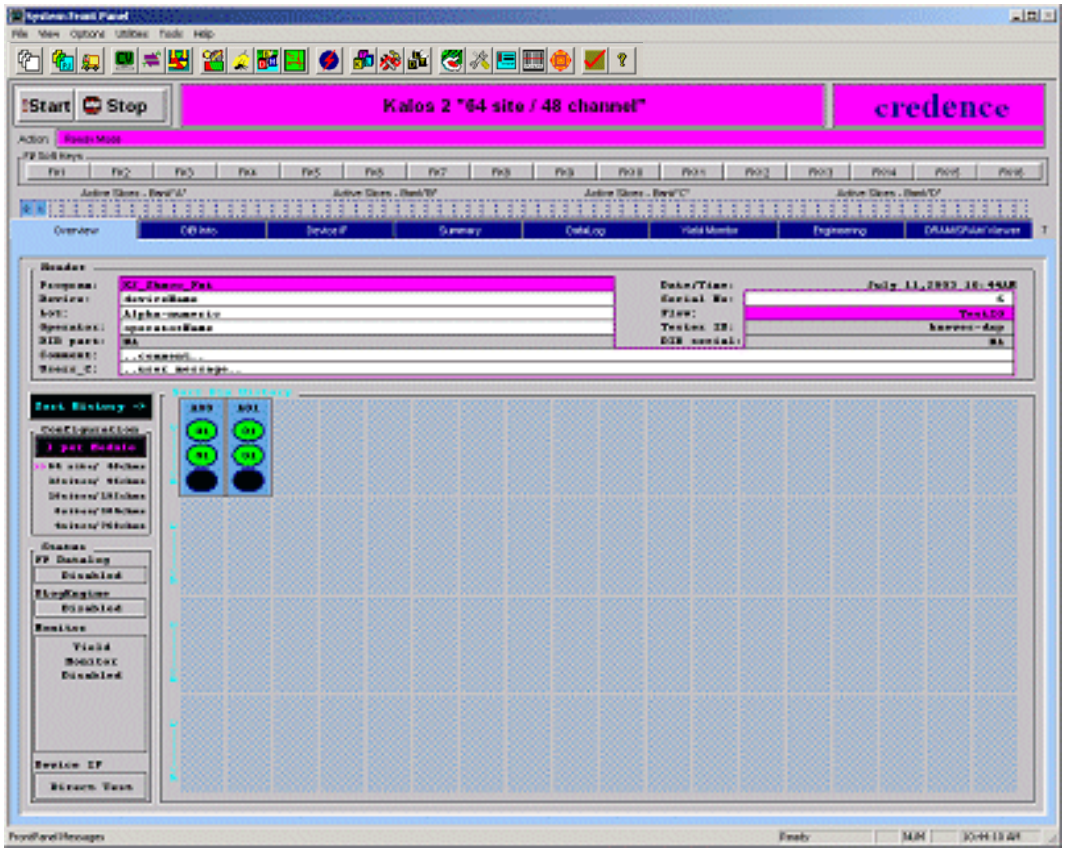
The area labeled Active Slices displays buttons which correspond to Kalos 2 slices in the system. Buttons for enabled Kalos 2 slices appear blue in color, while those for disabled slices display a black background. You can enable/disable any of the slices by clicking on them. If there is only one slice enabled, it cannot be de-selected (i.e., one slice must be enabled). Slices can be enabled or disabled on the Overview and Engineering property pages. (Any slice(s) brought up after Front Panel is launched will display as disabled.) Any board in the system can be selected or de-selected by clicking its corresponding button on this screen. Slices begin with slice A0 (Bank A Slice 1) and display up to D72 (Bank D Slice 18).

NOTE — Once a program is loaded, slices that have a valid program load appear blue. Any that do not have a valid program appear red.

Overview

The Overview property page displays the current system configuration, as well as all available hardware and software configurations. It is divided into functional areas: Kalos 2 Active Slices, Header, Configuration, Status (FP Datalog, DLogServer, Monitor, and Device IF), and Sort Bin Results as shown in Figure 76.

Figure 76. Overview Property Page



The Header area displays header information for the current test program. The first field, labeled Program, contains the test program file name which is read in at load time. The remaining fields contain descriptions and comments which are optionally input by the user.

Once a test program is loaded, the user may select any flow in the loaded test program by clicking on the Flow field. Clicking in the window displays a pulldown menu showing the defined flows from within the program.

The Sort Results -> which toggles to Sort History -> displays the Sort Bin Results of the previous three and current sort results. This includes the pass/fail condition, its sort category, and the Kalos 2 slice it was tested on.

The Configuration area shows DUTs per module of the last program that was loaded. This is an information only area; functions cannot be controlled.

The Status area displaying FP Datalog, DLogServer, Monitor, and Device IF are highlighted when enabled.

Kalos 2 Active Slices are under user control. Slices can be enabled or disabled by clicking the respective slice.

- At least one slice must be enabled.
- Slices must be physically present (slices appear across the panel).
- Slices that appear as *disabled* require rebooting.

Overview Property Page (Personal Kalos 2 - Optional)

Personal Kalos (PK2) sort views are displays in Figure 77. This view (optional condition) is provided for sort result and/or history on a PK2 test system.

The PK2 is defined as a one board system (two slices). Optional view is an expansion of the sort/history views for the single board tester.

Figure 77. Optional PK2 Sort Results

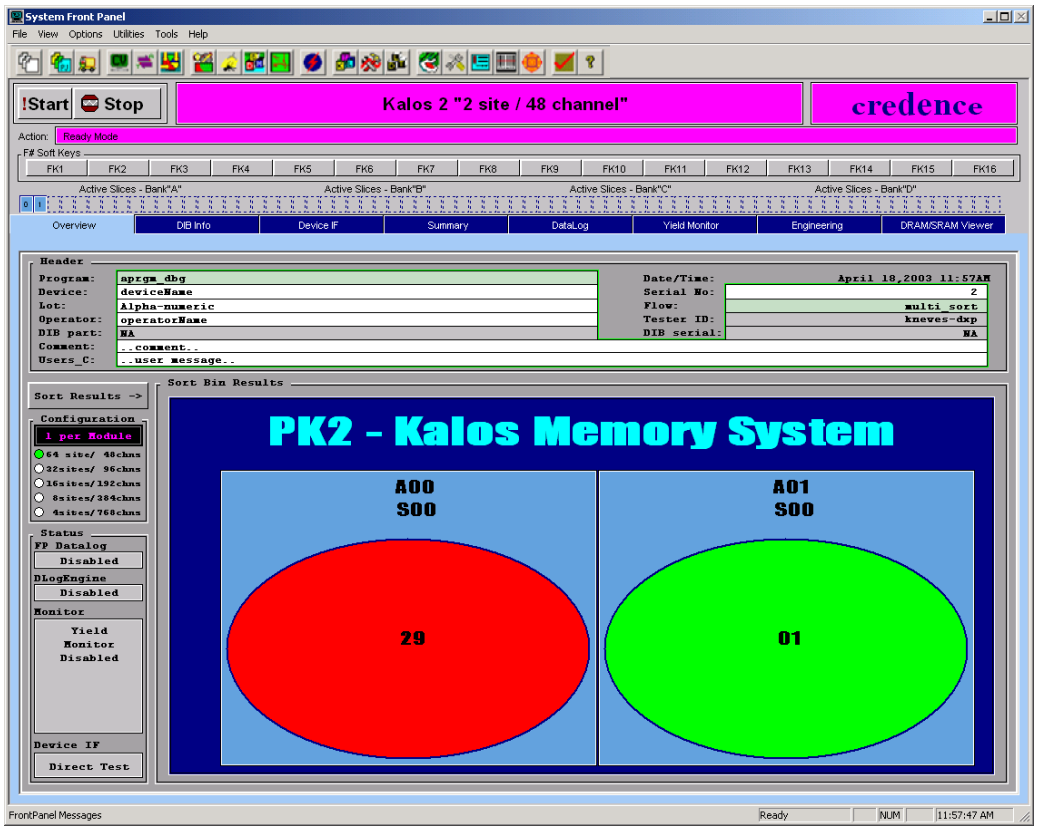
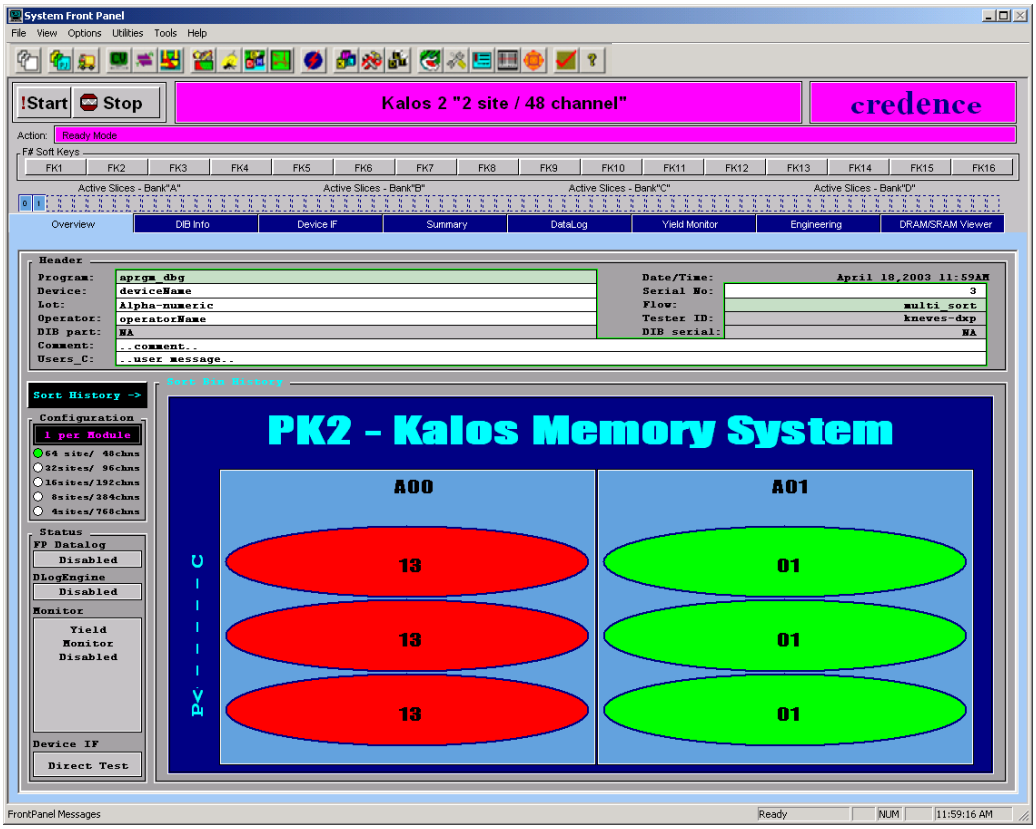


Figure 78. Optional PK2 Sort History



Operator IF Property Page

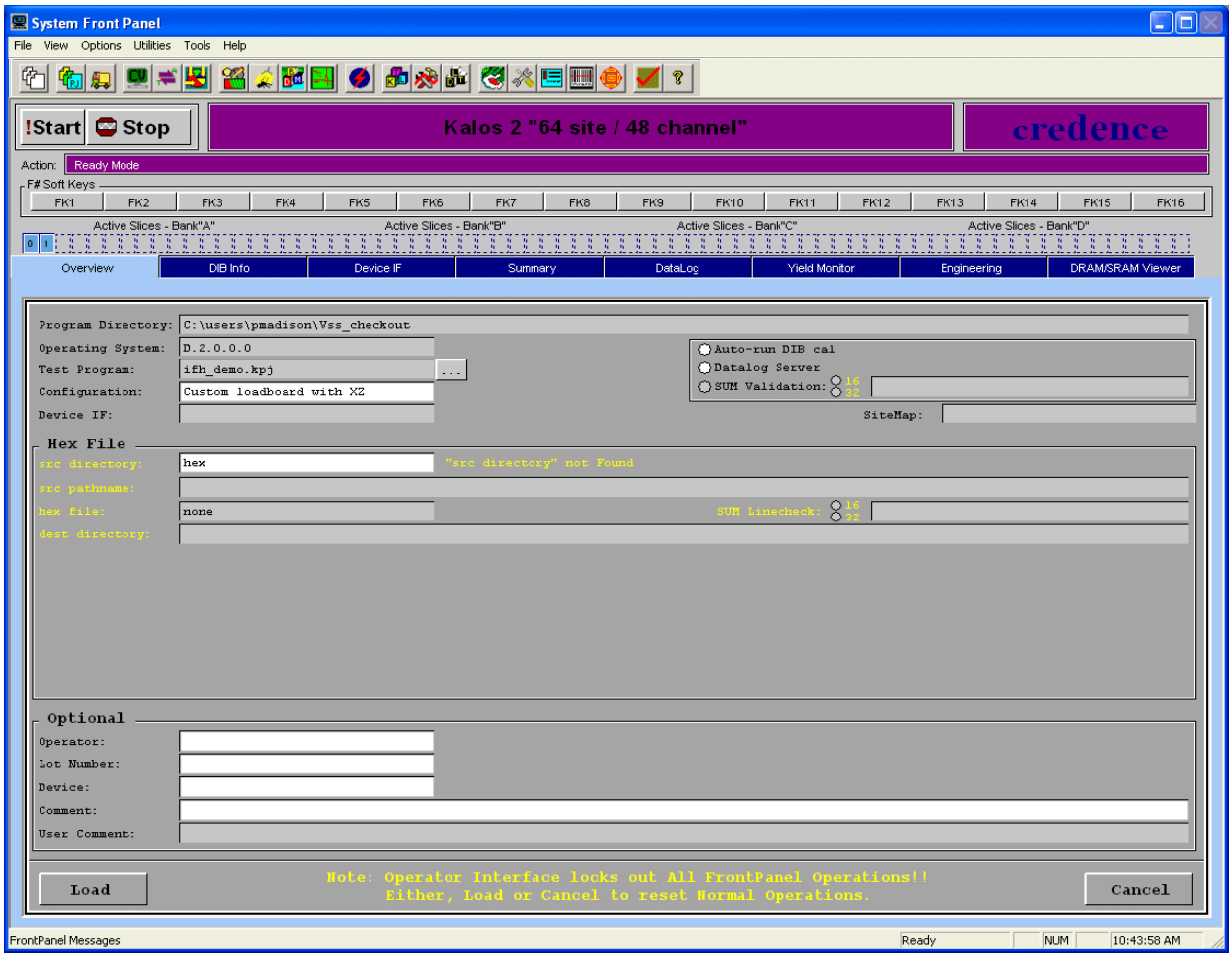
The Front Panel requires interaction on multiple pages: Overview, Dib Info, Device IF, and Yield Monitor. The Operator IF property page, shown in Figure 79, provides a one page program loading interface for Kalos 2 test systems. This property page allows the user to load GPIB drivers (DLL's) and perform an automatic dibcal, if enabled, before a program load. To access this property page, select *Operator IF* from the *File* menu of Front Panel.

Loading of the datalog server can be selected (radio button selection) by way of the Operator IF property page. There is also an option that loads and calculates the checksum for a selectable DBM file. The Operator IF validates the checksum by verifying it against another input (or checksum). The GPIB and hex file options are configurable within the project files.The user can also specify header information for the System Front Panel application.

Once the Operator IF is launched, it locks the Front Panel property pages until the user either loads or cancels the Operator IF operation by clicking on the applicable button (*Load* / *Cancel*) at the bottom of the property page.

NOTE — Device IF, yield monitor, and selectable options on the Operator IF feature are setup in the KPJ file.

Figure 79. Operator IF Property Page



DIB Info

The DIB application (see Figure 80) interacts directly with the Device Interface Board (DIB) Non-Volatile Memory (NVM) devices. It can perform the following tasks:

- Search and broadcast DIB NVM data to all the Kalos 2 boards.
- Allow interactive modification of the NVM contents if the NVM uses the recommended NVM format.
- Format a NVM device.
- Load the NVM from a file.

- Save the NVM contents to a file.
- Protect/Unprotect NVM data from change (factory use only).

The follow are *read only* view options available from the Front Panel DIB Info property page.

- Show a map of which slots are attached to NVM devices.
- Show the contents of any DIB NVM slots if the NVM uses the recommended NVM format.

DIB Info is the readback calibration status of each Kalos 2 slice. It has no relationship to the NVMDIB; the two are independent of each other. NVMDIB is the readback of the current device interface board, IDROMs, if the user has implemented them.

Detailed information on the NVMDIB utility is provided in the NVM User's Guide located under the Help menu of the NVMDIB utility.

DIB slices — Kalos 2 sites where a DIB-CAL will be performed.

DIB-CAL - ALL — Performs DIB-CAL on all available sites.

DIB-CAL

Status - current active status of DIB-CAL for the specified site(s).

Kalos Slices:

Condition => (status conditions):

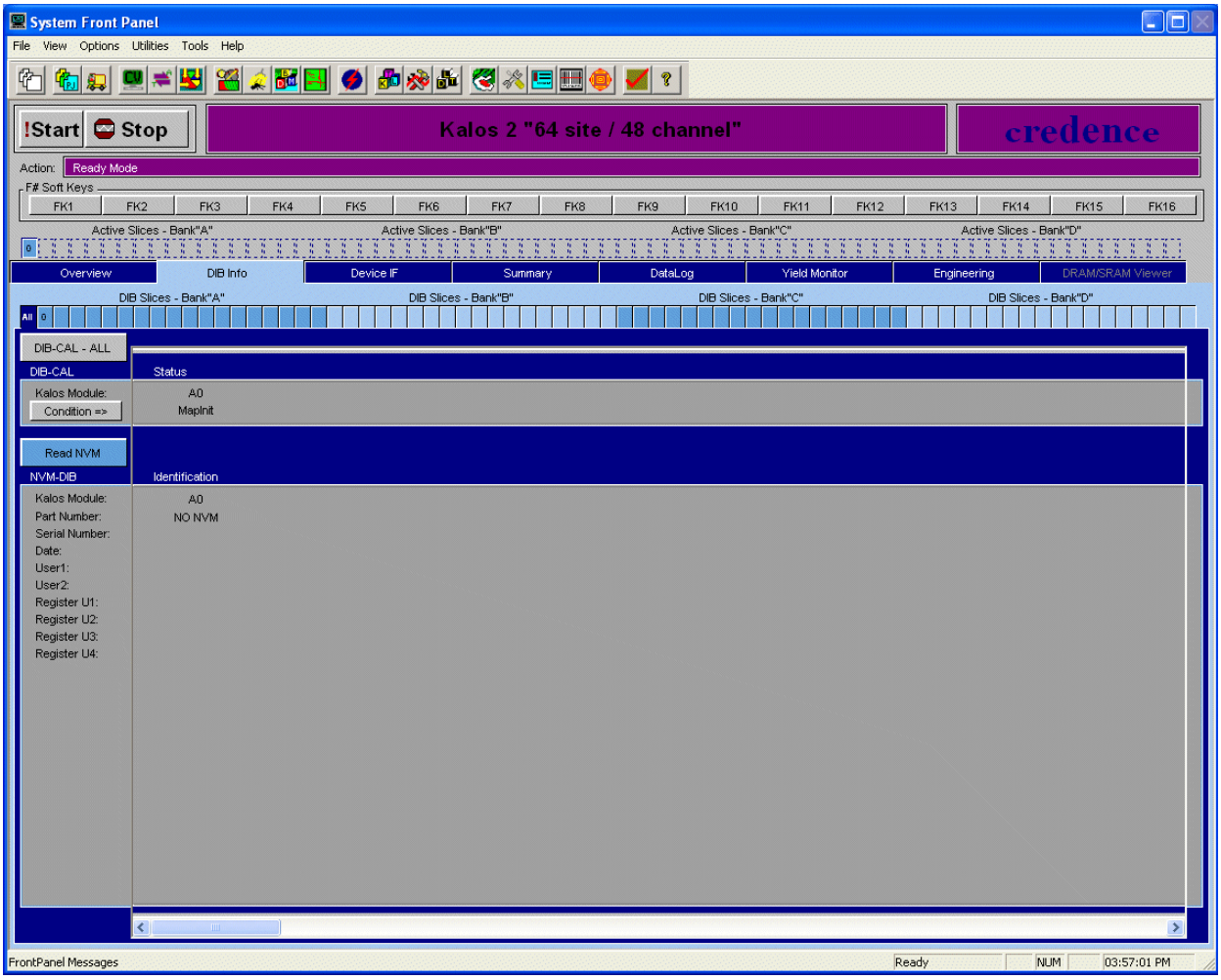
MapInit (nothing performed yet)
CAL Pass (passed dibcal - green) CAL Fail (failed dibcal)

Read NVM — Read IDROM on load board or probe card.

NVM-DIB

Identification - identifies all load board IDROM information.

Figure 80. DIB Info



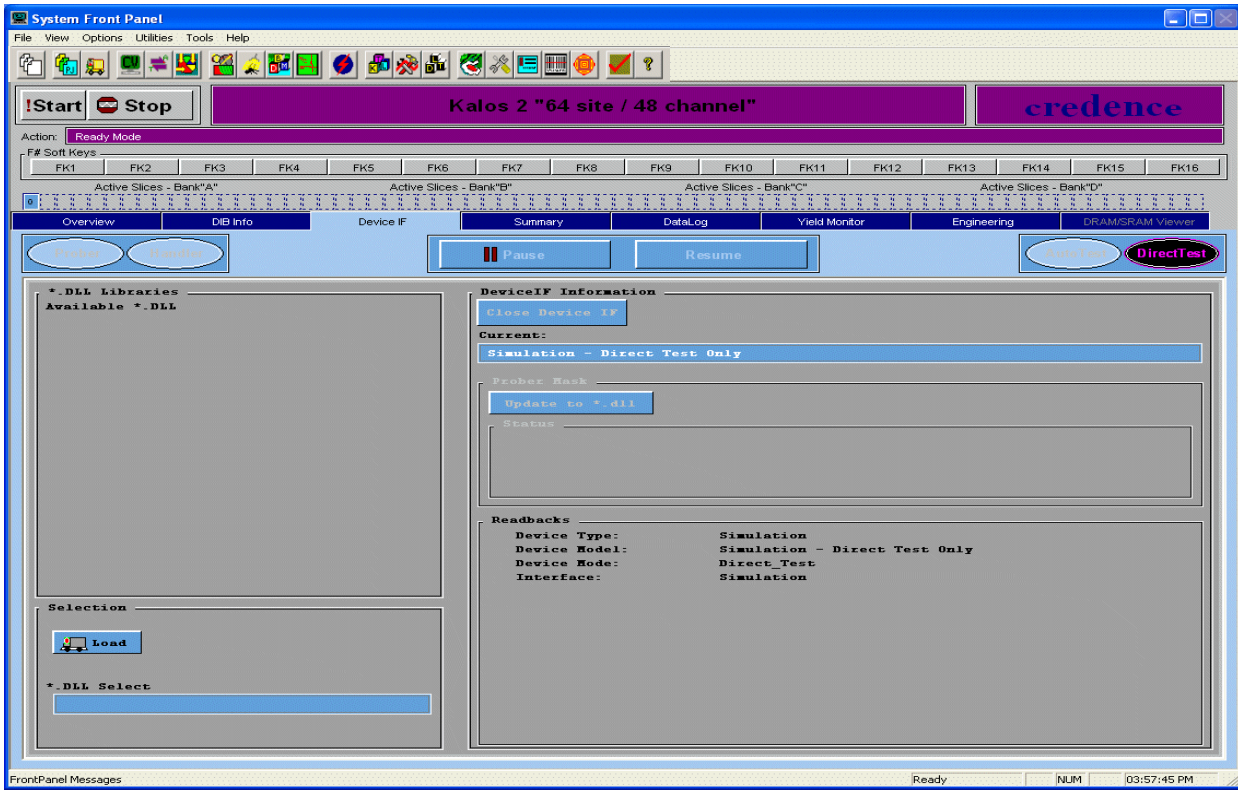
NOTE — Anytime the DIB Info property page is selected, the call for readback is automatically executed. It is not possible to edit the NVMDIB loadboard identification from this page.

Device IF

The Device Interface (Device IF) property page, shown in Figure 81, contains information for any peripheral probing or handling device.

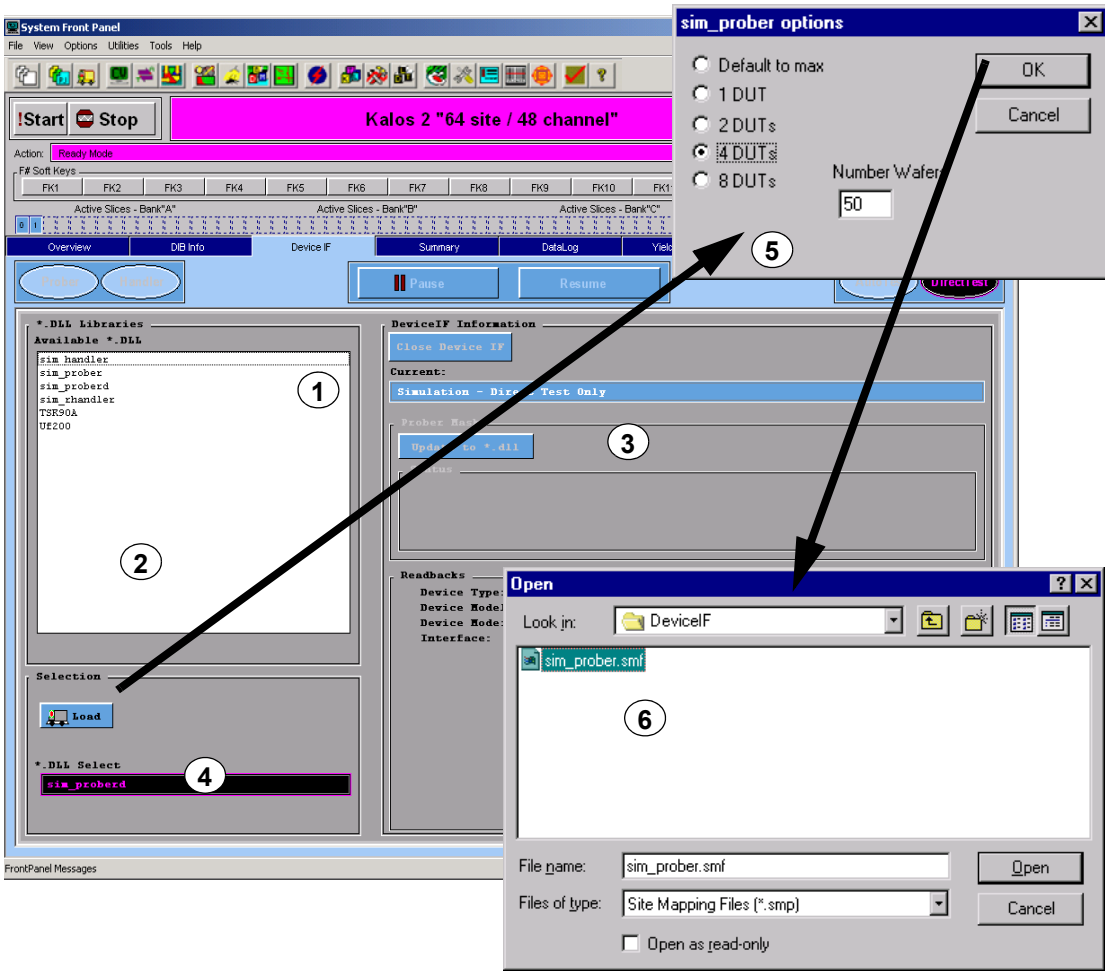
Direct Test or manual mode is the default mode of the tester. In manual mode, the test start command is sent directly to active slices when the Start button is clicked. Testing is completed after test results are reported for every slice, at which time the Start button may be clicked again.

Figure 81. Device Interface Property Page



The *.DLL Libraries area contains a list of software drivers for peripheral wafer probers and handlers. From this list the user may install the proper driver for the equipment being used. Load the specified driver by clicking on it and then depressing the *Load* button. Confirm that the driver is loaded by the text that appears under *Current* in the DeviceIF Information area (see Figure 82). Credence maintains and can provide a list of supported prober and handler equipment drivers.

Figure 82. Device Interface Loading



(1) Control (if activated by a loaded *.dll program) and current testing status.
(2) ListBox showing current *.dll programs that are available.
(3) Current information of the *.dll loaded.
(4) Selected *.dll Filename. Clicking on a filename in the ListBox (2) selects that *.dll program for the “Load” operation. Three step process: (4, 5, and 6).

After loading, the tester goes into automatic mode. Once the driver is loaded and you are ready to start testing, click on the *Start* button. In Single Site testing you will not need to choose the Site Mapping File (SMF). The SMF maps the DUTs to slices.

If you are in AutoTest Mode and you press the *Stop* button, a dialog box appears confirming the stop auto test action. Tests on the wafer continue to execute until you select *Yes* or *No* from the dialog box. If you choose *Yes*, the current test will complete execution for that die and bin out. If you choose *No*, it acts as a cancel and testing continues.

NOTE — If you are in manual mode and you press the Stop button, the test stops immediately.

The DeviceIF Information area displays the type of interface and characteristics of the interface, such as the Device Type, Device Mode, the Diameter of the Wafer, and temperature you are testing at.

To update the prober mask, click on the *Update to .dll* button under the Prober Mask area.

The *Readbacks* area specifies the data structure from the selected *.dll.

NOTE — The Pause button, when depressed, completes the current test and then halts the test program. The Resume button continues from the pause location.

Summary

The Summary property page, shown in Figure 83, provides an interface for getting current summaries using either a text table format or graphical displays such as bar or pie graphs for the selected Kalos 2 slices. Summary information includes the header of the current test program: totals for number of devices tested, number passed, and number failed, as well as a breakdown of the binning categories. Basic features of the Summary property page include:

- Summary (Kalos 2 formatted) text table and multi lot summaries with Kalos 2 slice selections for individual and/or composite summary viewing.
- Bin summaries (graphical) bar charts for sort, soft, and functional bins (FBins) for online lot displays only. Kalos 2 slice selections are also available (see Figure 84).

Figure 83. Summary Property Page (Text Sums)

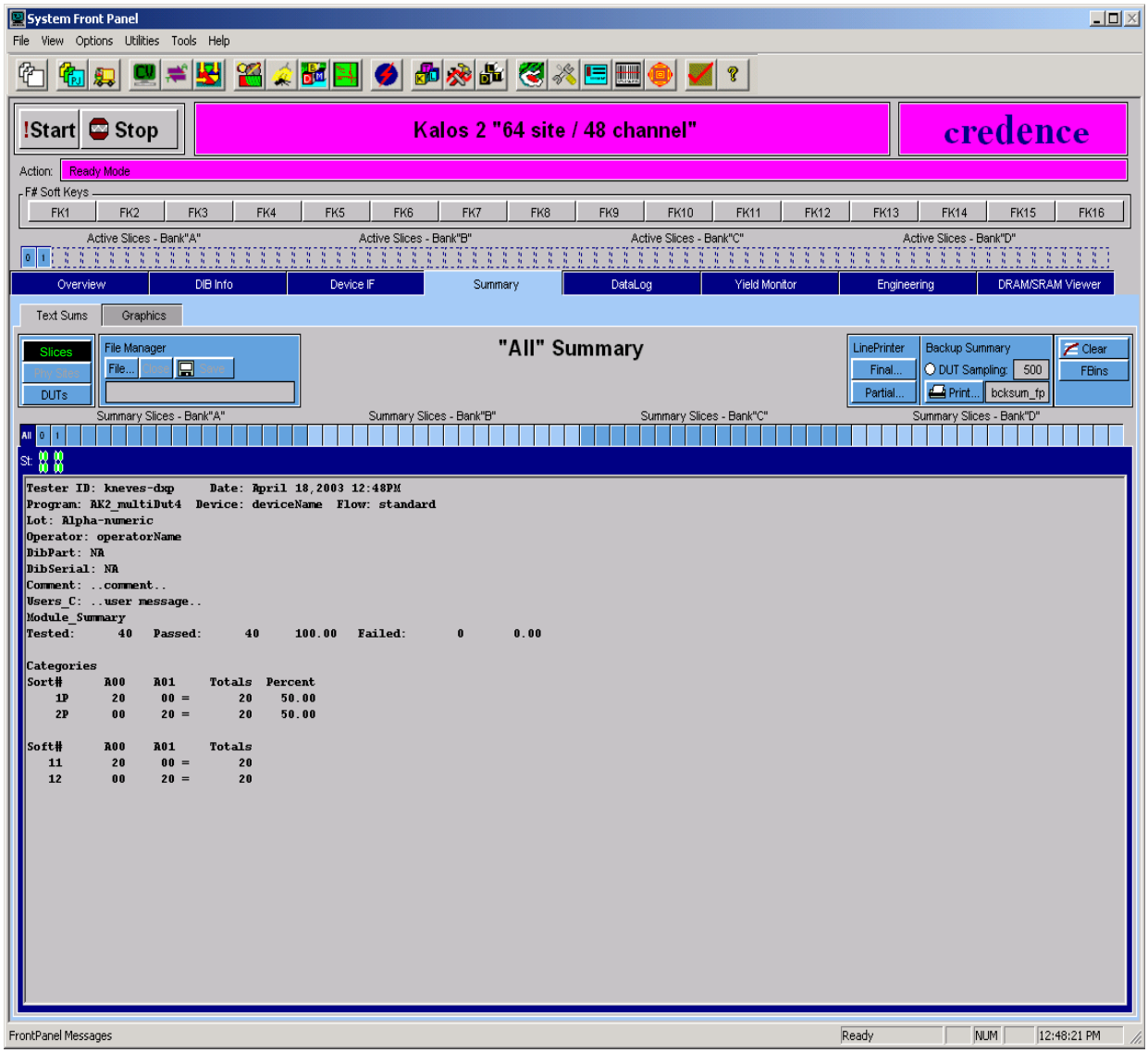
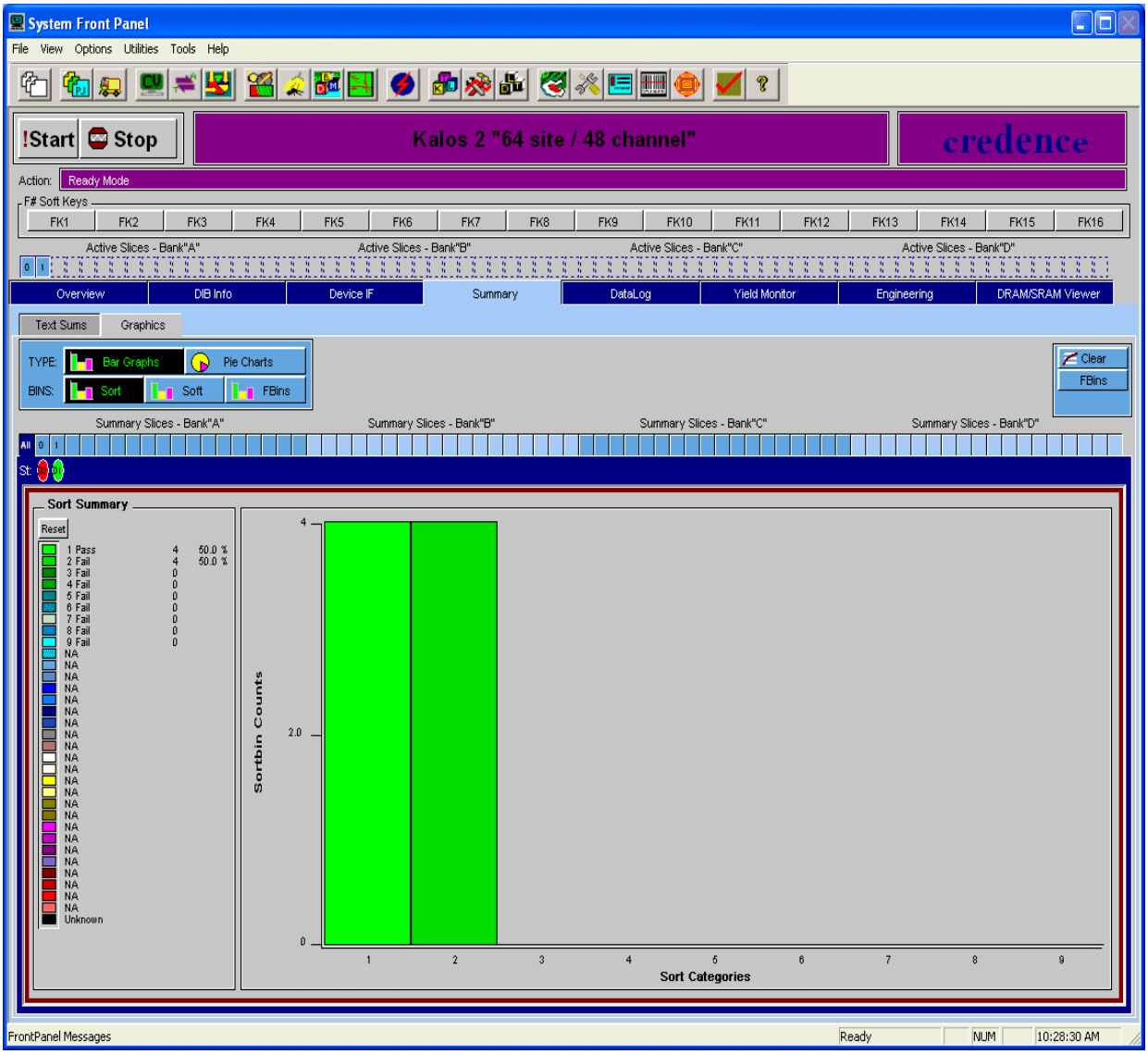


Figure 84. Summary Property Page (Graphics)


System Front Panel
File View Options Utilities Tools Help
!Start Stop
Kalos 2 "64 site / 48 channel"
credence
Action: Ready Mode
F# Soft Keys
FK1 FK2 FK3 FK4 FK5 FK6 FK7 FK8 FK9 FK10 FK11 FK12 FK13 FK14 FK15 FK16
Active Slices - Bank"A" Active Slices - Bank"B" Active Slices - Bank"C" Active Slices - Bank"D"
Overview DIB Info Device IF Summary DataLog Yield Monitor Engineering DRAM/SRAM Viewer
Text Sums Graphics
TYPE: Bar Graphs Pie Charts
BINS: Sort Soft FBins
Clear
FBins
Summary Slices - Bank"A" Summary Slices - Bank"B" Summary Slices - Bank"C" Summary Slices - Bank"D"
Sort Summary
Reset
1 Pass 4 50.0 %
2 Fail 4 50.0 %
3 Fail 0
4 Fail 0
5 Fail 0
6 Fail 0
7 Fail 0
8 Fail 0
9 Fail 0
NA
Unknown
Sortbin Counts
Sort Categories
FrontPanel Messages
Ready
NUM
10:28:30 AM

Functionality

The Kalos 2 defined summary structures are divided into four groups: header, totals, sort categories, and soft categories.

Two tabbing methods are available for viewing: text summaries (Text Sums) and graphical summaries (Graphics). To select a view, left mouse click on the desired tab. The graphic views may be toggled to select specific views. *Bar Graphs* or *Pie Charts* are selected from TYPE. The BINS selection displays *Sort*, *Soft*, and *FBins*.

Text Sums

In Figure 83 only Kalos slices A00 and A01, which are the Total, Sort (Optional: Multi-DUT - individual summaries) and the Soft binning results. The device counts and the their respective percentages are displayed with or under defined labels.

If a prober *.dll is loaded, then two summary types are made available to the user: a standard text summary and the optional text wafermap. Printouts are available for both summaries (standard text summary file **.smy* and the wafermap file **.wmp*).

FBin is an optional function that is available for displaying KTL FBins, if they are in the currently loaded program.

Figure 83 illustrates the summary showing the current active Kalos 2 slices (A00 and A01). If an individual Kalos 2 slice summary is desired, click the respective summary slice tab for the results of that slice.

NOTE — Switching between views does not destroy summary data.

The system type (Kalos 2 “64 site / 48 channel”) is displayed at the top, next to the Start/Stop control buttons.

The second header “All” Summary, shown in Figure 83, is determined by the selection of the tab (All, or A00 through D17) (Banks A, B, C, and D, #’s 0-17) on the System Front Panel Summary Property page. Figure 83 shows the Tab *All* selected, which comprises all the enabled Kalos 2 slices. In this case, A00 and A01 are the only enabled slices. If A00 or A01 are selected, then the “All” Summary changes to Kalos(#) Summary.

Summary Graphics

The *Graphics* selection provides viewing options for bar graphs or pie charts (opposite TYPE:). Sort, soft, or FBins viewing selections are available opposite BINS: (see Figure 84).

Primary Window

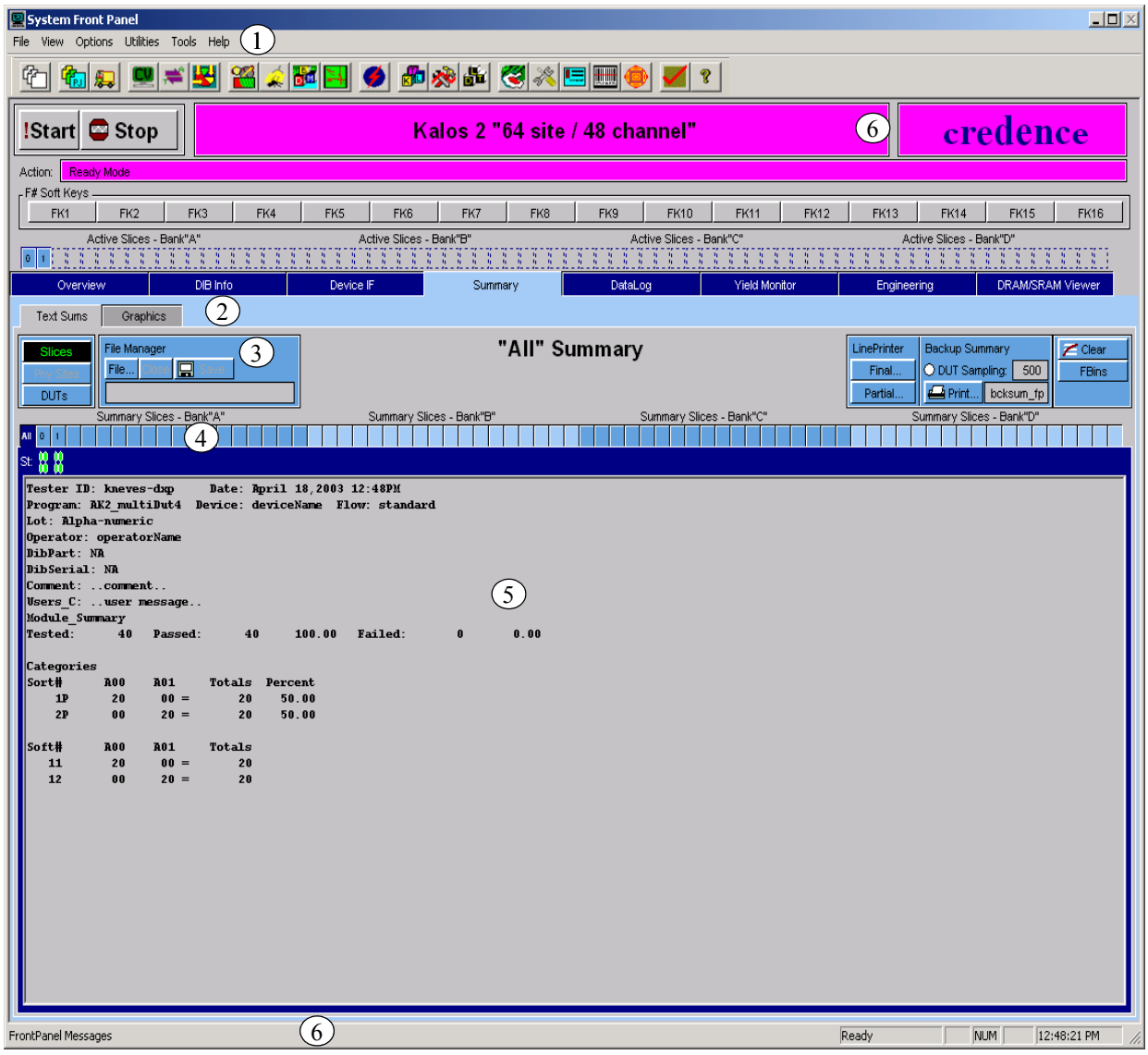
The primary window of the Summary feature is divided into view or control areas. See Figure 85 for the location of the following areas:

1. Menu and toolbar
   Interface for selecting the operations of the application.
2. Property page (tab)
   Functional page selection (Text Sums/Graphics).
3. Control area
   Specify control and/or mode selection.
4. Slice tabs
   Select Kalos 2 slice(s) for viewing.

5. Draw area
   Displays selected views.

6. Current status / messages (two locations)
   Displays status and messages.

Figure 85. Primary (Main) Window



Primary Window Functions

The following is a description of features contained within the main Summary window. See Figure 86 for locations.

1. Control Area -

- Text Sums / Graphics - Selection of text summary or graphics (bar graphs or pie chart).
- WaferMap - Graphical view (interpretation) of the text wafermap information. Location in relationship to die, information behind xy coordinates, pass/fail information, etc.
- Interactive - Allows interaction (by way of pausing) with a particular or problem wafer/die.
- Slices - Displays text summary information of the selected slice(s).
- Phy Site - Displays the actual (physical) site location.
- DUTs - Displays text summary information on the selected slice with an expansion of DUTs per slice.

File Manager:

File...	Allows the user to save the contents of the current summary to a text file. (This function requires clicking on the Save button.)
Close	Shortcut for closing the current file.
Save	Saves the current summary to a named file. If no filename is specified, the save action is ignored.

LinePrinter: Generates a hard copy of the current summary and sends it to the selected printer. In order for the print function to work, a printer must be set up for the system. Refer to the Windows XP online help if instructions for printer setup are needed.

Final...	Sends the summary to a printer (also saves the summary to a backup file) and clears all summaries.
Partial...	Same as Final except it does not clear summaries.

Backup Summary:

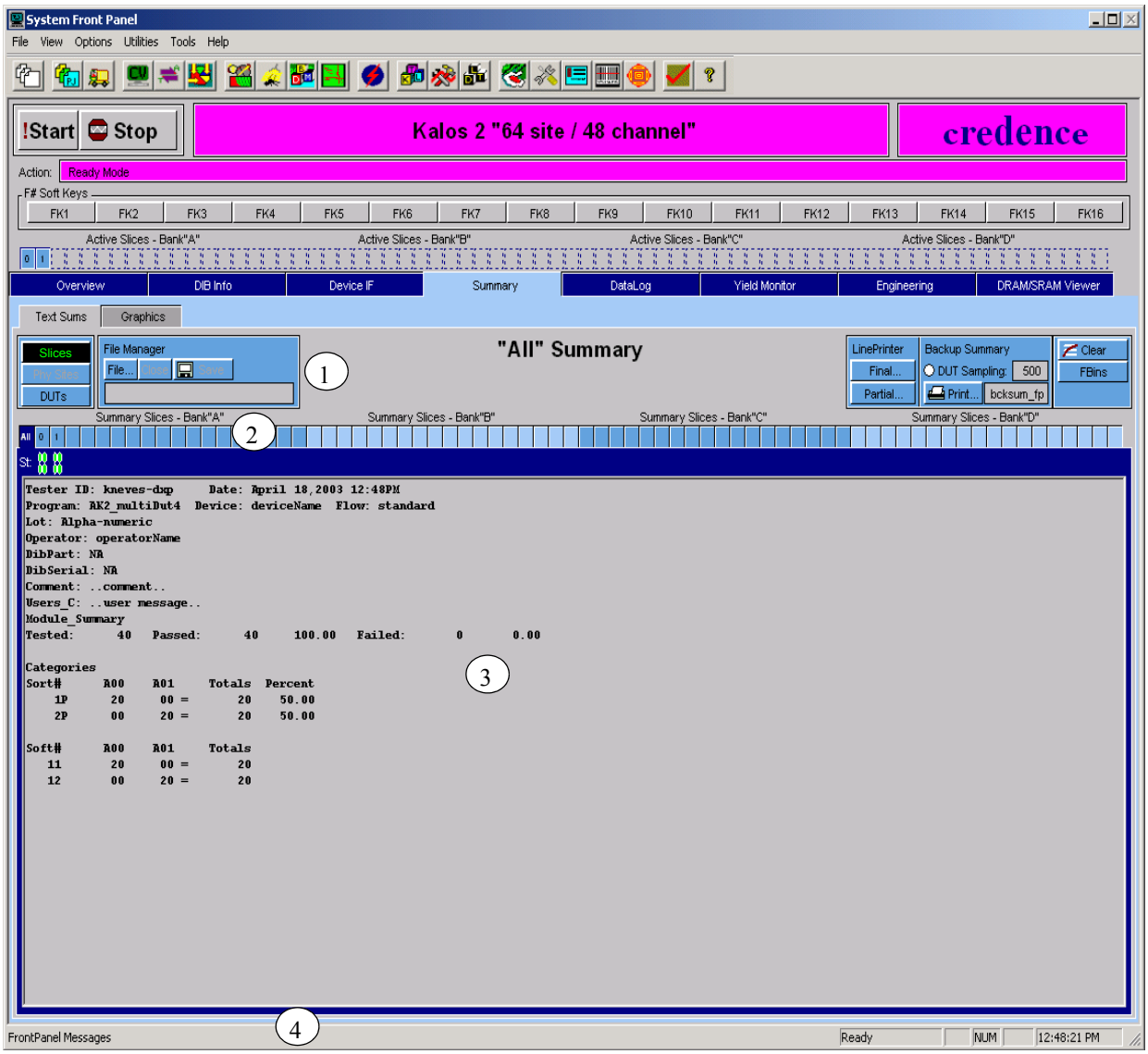
DUT Sampling

If enabled, automatically saves to a backup file.

	Print...	Prints the last summary that was transferred to a backup file.
Clear		Erases any information currently displayed in the window.
FBins		Functional bins (FBins) visible (highlighted) if Get FBins button is enabled.
Get FBins		Gets current FBins from enabled Kalos 2 slices (if all slices are in Ready state).

2. Summary Slices tabs - Graphical tabs that when clicked, select the Kalos 2 slice for individual viewing. The “All” tab combines all available slices.
3. Draw area - User selected functional page. Displays selection of summary text or graphic.
4. Status bar - Displays the status of the application, including real time clock.

Figure 86. Primary Window Layout



Text Summaries

The summary text table is a composite (All) summary with the totals added automatically for the selected slices. A summary text table is displayed in Figure 86, item 3.

Summary Graphics

The summary provides multiple views of current summaries of active Kalos 2 slices. Two types of views are available under this property page. They are bar graphs and pie charts. The selection of which view is displayed is determined by clicking the *Bar Graphs* or *Pie Charts* selection next to the *TYPE* button.

Individual Kalos 2 summaries can be viewed by clicking on the applicable summary slice subtab. Selecting the *All* (the default) subtab displays a composite summary of all enabled slices.

NOTE — Switching between display views does not destroy data.

Summary Bar Graphs

Clicking the Bar Graphs button displays a bar graphic view of the composite (All) summary. Figure 87 is a bar graph representation of the previous summary text table. The draw area is divide into two sections: Sort, Soft, or FBins summary (selected from the *BINS* option) and the bin counts category bar graph.

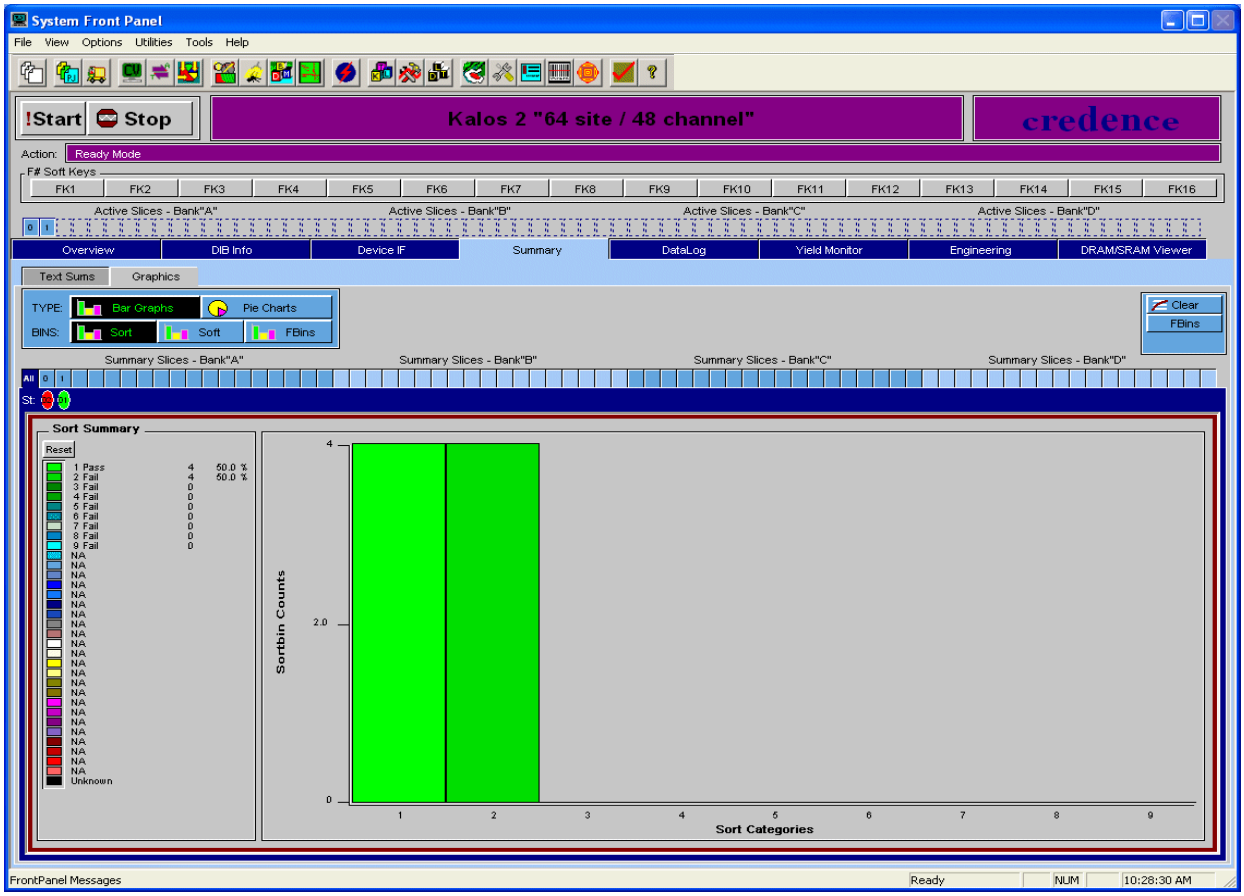
The Sort Summary consists of a color key for each sort number and its respective Pass/Fail assignment. The Pass/Fail assignment is determined by the bin table of the current program.

The bar graph is an xy coordinate display of the die counts versus the selected bins categories:

Bins	Bin flow - defines hard bins 0-31
Soft	Bin flow - defines soft bins 0-255
FBins	KTL program - defines functional bins 0-1023

NOTE — This is a Viewer only property page. Interactive operations are not available.

Figure 87. Summary Bar Chart


System Front Panel
File View Options Utilities Tools Help
!Start Stop
Kalos 2 "64 site / 48 channel"
credence
Action: Ready Mode
F# Soft Keys
FK1 FK2 FK3 FK4 FK5 FK6 FK7 FK8 FK9 FK10 FK11 FK12 FK13 FK14 FK15 FK16
Active Slices - Bank"A" Active Slices - Bank"B" Active Slices - Bank"C" Active Slices - Bank"D"
Overview DIB Info Device IF Summary DataLog Yield Monitor Engineering DRAM/SRAM Viewer
Text Sums Graphics
TYPE: Bar Graphs Pie Charts
BINS: Sort Soft FBins
Clear FBins
Summary Slices - Bank"A" Summary Slices - Bank"B" Summary Slices - Bank"C" Summary Slices - Bank"D"
Sort Summary
Reset
1 Pass 4 50.0 %
2 Fail 4 50.0 %
3 Fail 0
4 Fail 0
5 Fail 0
6 Fail 0
7 Fail 0
8 Fail 0
9 Fail 0
Unknown
Sortbin Counts
Sort Categories
FrontPanel Messages
Ready
NUM
10:28:30 AM

Summary Pie Charts

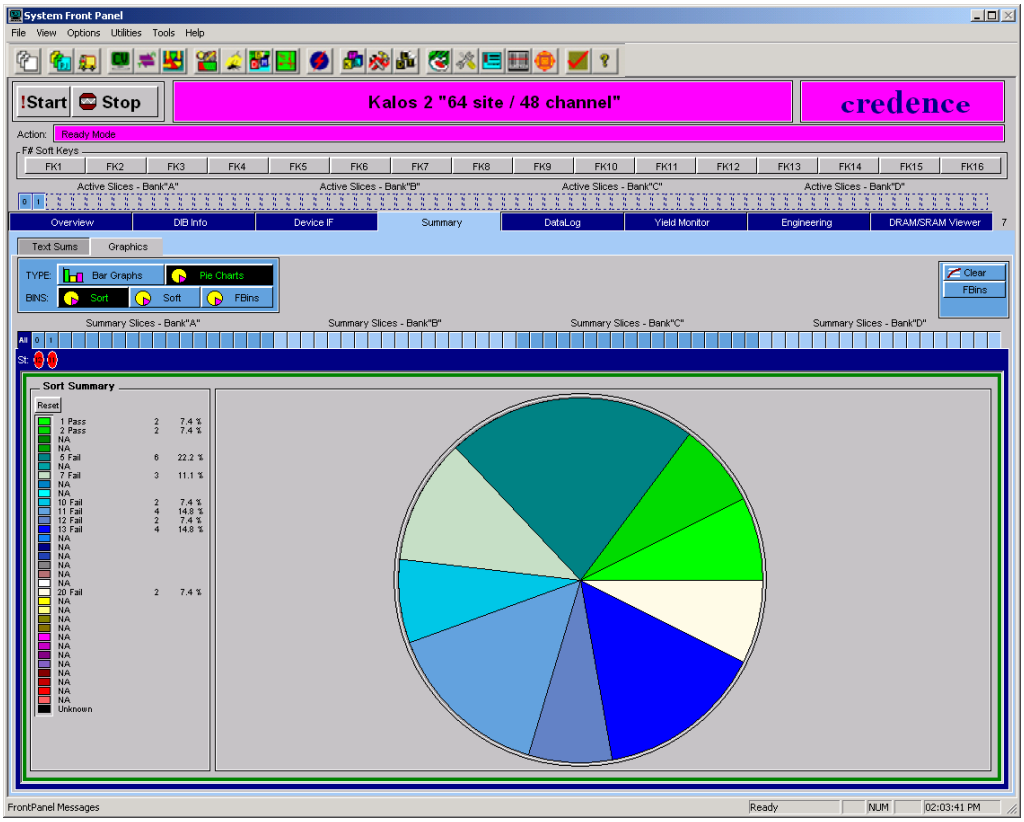
Clicking the *Pie Charts* button displays a pie chart view of the composite (All) summary. Figure 88 is a pie chart representation of the previous summary text table. The draw area is divide into two sections: Sort, Soft, or FBins summary (selected from the *BINS* option) and the pie chart.

The Sort Summary consists of a color key for each sort number and its respective Pass/Fail assignment. The Pass/Fail assignment is determined by the bin table in the current program.

The pie chart is a graphical display of the die counts versus the selected bins categories converted into pie slice percentage of a whole.

NOTE — This is a viewer only property page. Interactive operations are not available.

Figure 88. Summary Pie Charts


System Front Panel
File View Options Utilities Tools Help
!Start Stop
Kalos 2 "64 site / 48 channel"
credence
Action: Ready Mode
F# Soft Keys
FK1 FK2 FK3 FK4 FK5 FK6 FK7 FK8 FK9 FK10 FK11 FK12 FK13 FK14 FK15 FK16
Active Slices - Bank"A" Active Slices - Bank"B" Active Slices - Bank"C" Active Slices - Bank"D"
Overview DIB Info Device IF Summary DataLog Yield Monitor Engineering DRAM/SRAM Viewer
Text Sums Graphics
TYPE: Bar Graphs Pie Charts
BINS: Sort Soft FBins
Clear
FBins
Summary Slices - Bank"A" Summary Slices - Bank"B" Summary Slices - Bank"C" Summary Slices - Bank"D"
Sort Summary
Reset
1 Pass 2 7.4 %
2 Pass 2 7.4 %
5 Fail 6 22.2 %
7 Fail 3 11.1 %
10 Fail 2 7.4 %
11 Fail 4 14.8 %
12 Fail 2 7.4 %
13 Fail 4 14.8 %
20 Fail 2 7.4 %
Unknown
FrontPanel Messages
Ready
NUM
02:03:41 PM

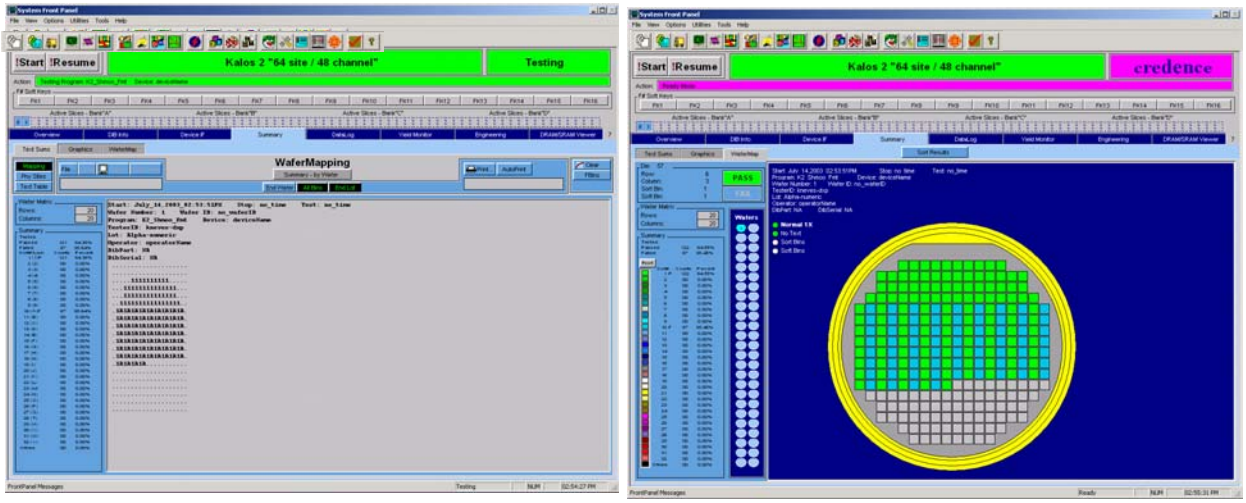
Wafermap Feature

The Wafermap feature is a read only (data container) engineering tool. If a prober *.dll is loaded, then two summary types are made available to the user: a standard text summary and the optional text wafermap (see Figure 89). Printouts are available for both summaries (standard text summary file *.*smy* and the wafermap file *.*wmp*). The Kalos 2 tester is the master while the prober is the slave. Testing is controlled by the Kalos 2 tester while the prober moves across the wafer.

A driver is loaded by way of the System Front Panel application Device IF property page. Depressing the Start button loads the Site Mapping File (SMF). Once the driver is loaded, the tester is put into automatic mode. From this property page you can pause and restart the test. Keep in mind that if the test is paused, the prober should not be touched. If another site is chosen, the tester will continue testing from the point the test was paused.

NOTE — The driver that is used may or may not use a mask of the Wafer. This depends on the driver.

Figure 89. Text Summary and Wafermap File

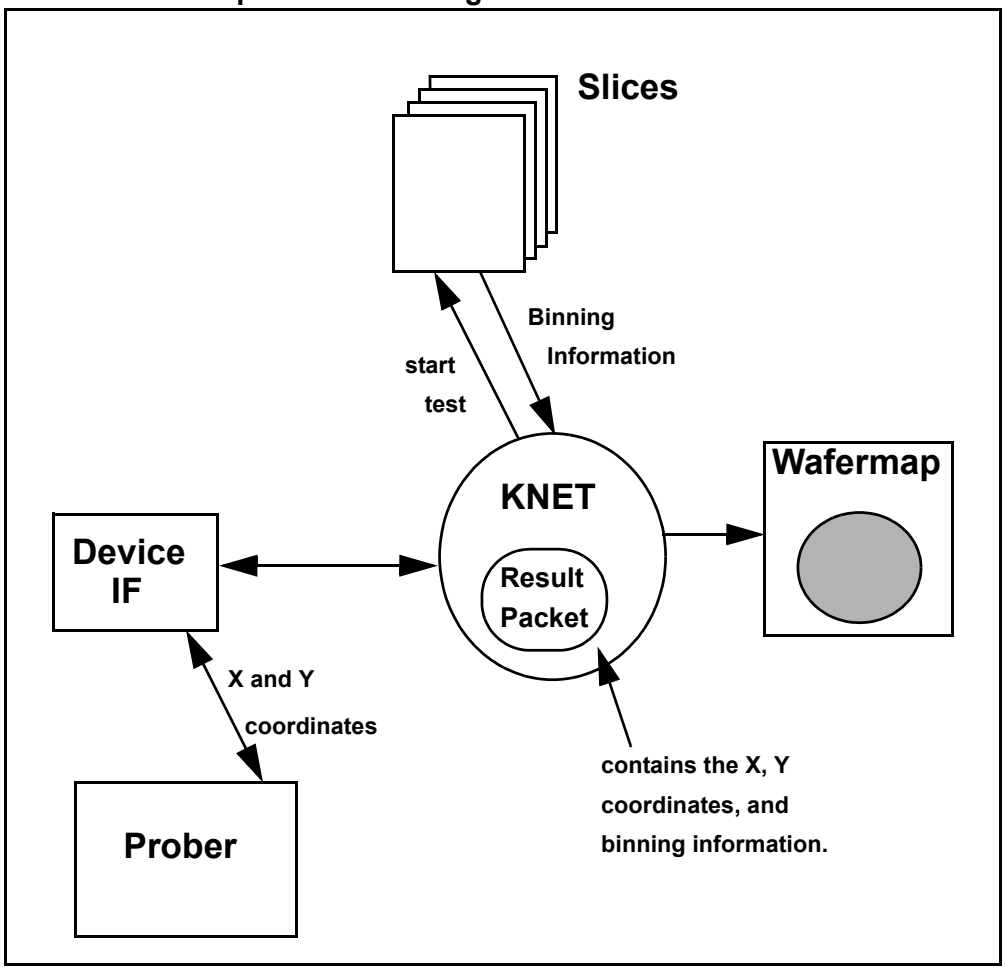


Text summary Wafermap graphic

The information received by the Wafermap is used to generate the map. This data comes from the prober and the tester. The prober supplies the X and Y coordinates, while the tester supplies the binning (sort and soft bin) information to the Wafermap through the result packet. The results packet resides in KNET (Kalos network software functions and code), as shown in Figure 90. The Wafermap has no control over the prober or the tester, as it is a read only tool.

NOTE — In automatic mode you can start or stop the test from the prober or the tester. Otherwise, the test stops when the executable Kalos test program (.kbi) is completed.

Figure 90. Wafermap Functional Diagram



The Wafermap displays pass/fail results, or sorted die categories of selected wafers, plotted within a two-dimensional coordinate system. Basic features include:

- Mask Editor and Generation
- Data Evaluation Mode
- Composite Modes
- Graphical Operations

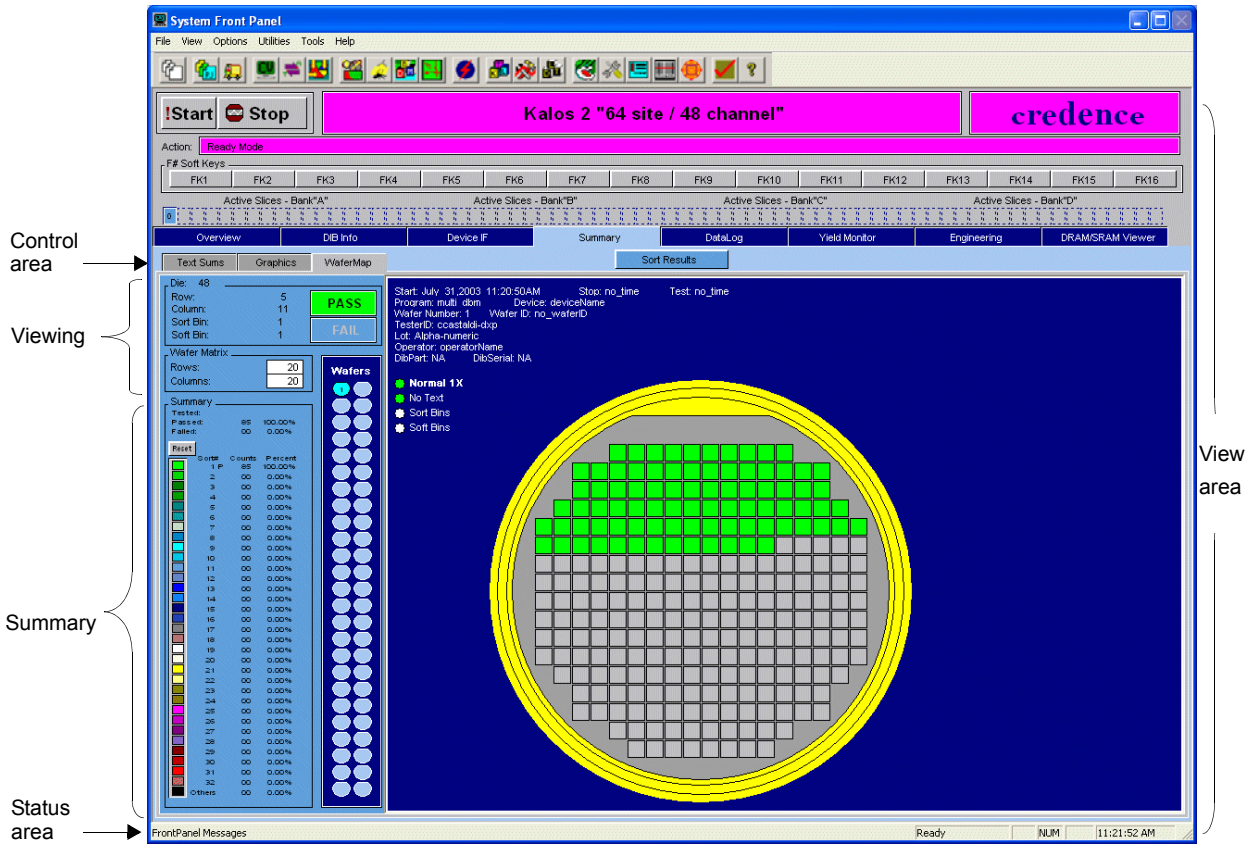
There are two functional operations available on the Wafermap: Sort Results and Mask Editor. The basic top level window (see Figure 91) of the Wafermap is subdivided into multiple view or control areas, these are:

- Control Area - Execution control and mode selection.
- Viewing - Pass/fail condition, die number and row/column position.
- Summary - Standard wafer summary report.

- View Area - Graphical representation of wafer data and/or summaries.
- Status Area - Tool messages, test status, time, etc.

Normal operation, both interactive and automatic, uses the tester's hardware and its supplied software utilities. Usually the user provides the test program flow, which supplies the sorting and binning criteria, the pass/fail criteria, and all the individual test setups.

Figure 91. Wafermap Tool



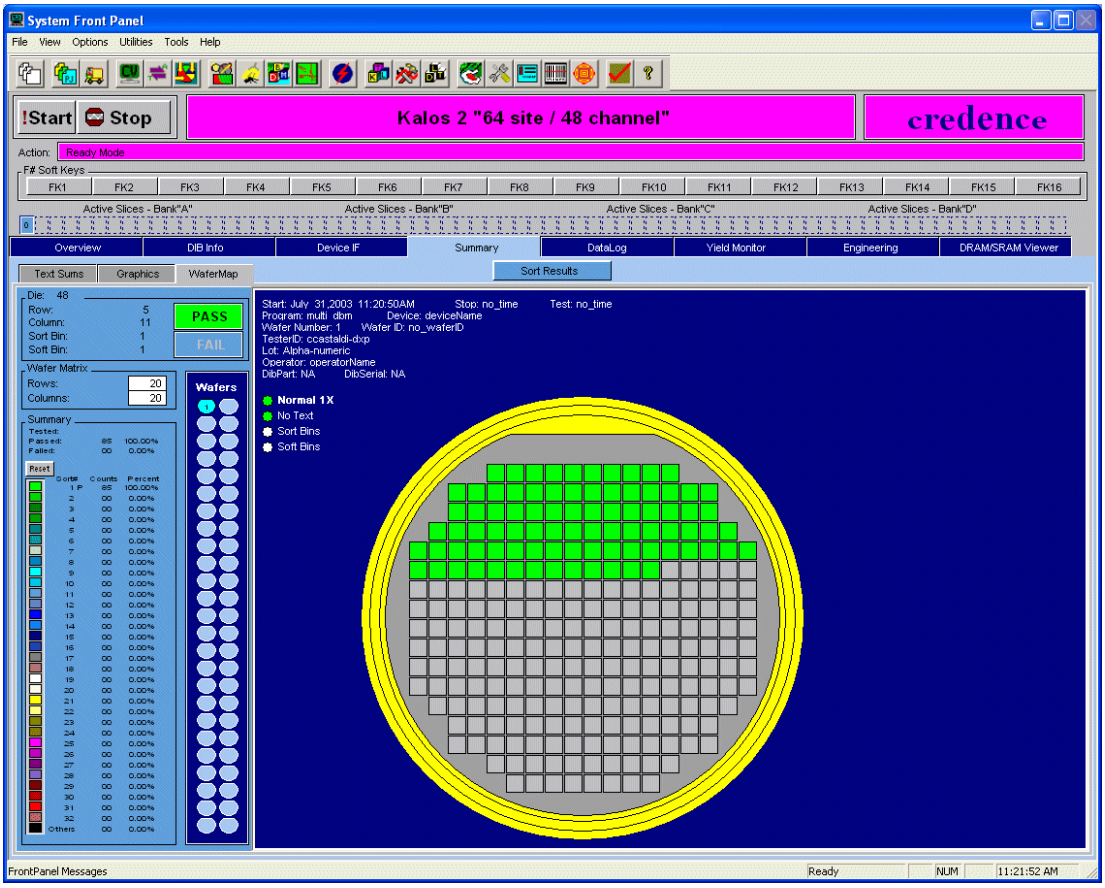
The following describes basic functions of the Wafermap feature property pages.

Sort Results

The Sort Result property page, shown in Figure 92, displays results of the test program currently running or the last completed wafer.

There is no Interactive Mode available to the user.

Figure 92. Sort Property Page

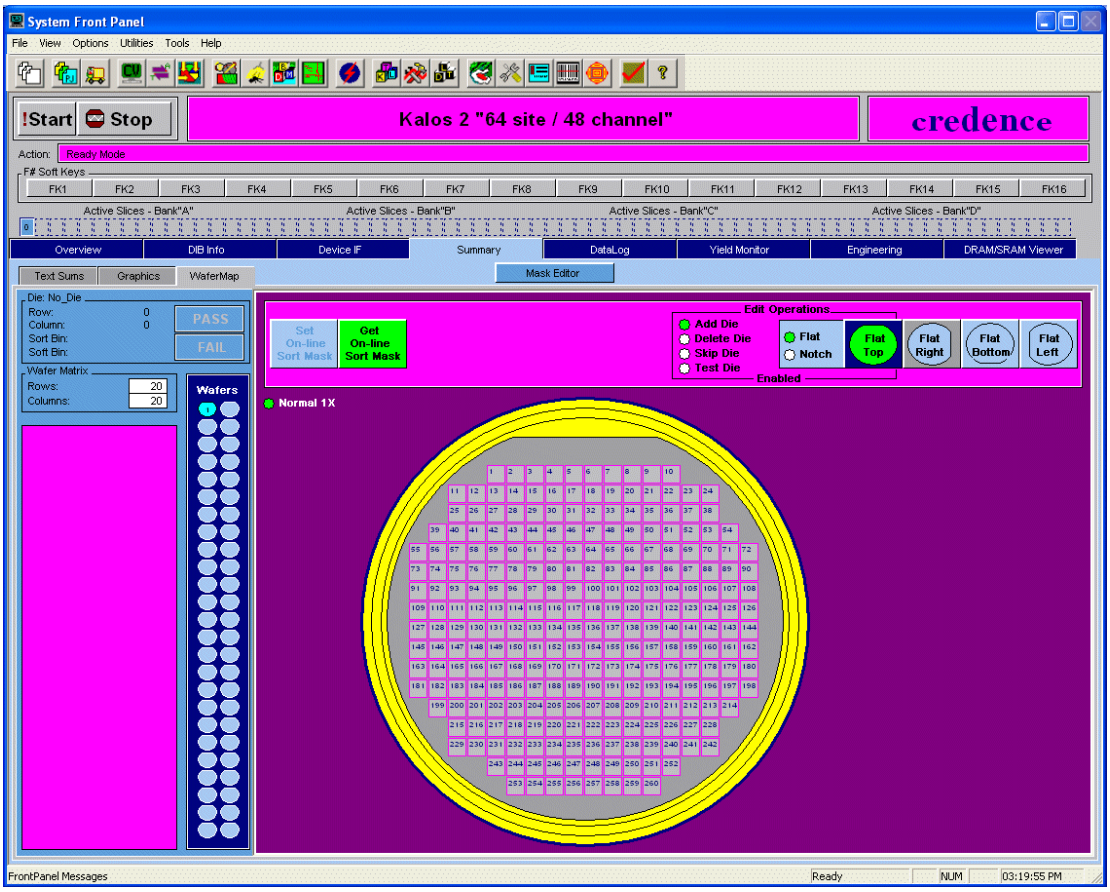


Mask Editor

The Mask Editor property page, shown in Figure 93, allows the user to define and edit the wafer mask by number of rows, number of columns, add die, delete die, skip die, and test die. The *Get On-Line Sort Mask* option gets the current mask into editor mask. The user can generate a wafer mask for the selected device type, which can be used for all available modes of the Wafermap. The generated mask is used to represent the product die, the test die, and the skip die placements.

The initial generation of the wafer mask is determined by the number of row (x) and columns (y) selected, with the rectangle (die) corner points being in a circle (wafer). The editor allows you to add or subtract die, and designate skip or test die.

Figure 93. Mask Editor Property Page



NOTE — Included is a Get Sort Mask push-button for transferring the current online mask into the editor mask.

Automatic Mode (Production)

Automatic mode provides for data gathering and visual display of the current wafer sorting action, with an instant summary of the executing wafer. The viewing area of the Wafermap window is under user control for defining which optional views are active. By default, the draw area shows a single wafer graphical view of the sorting criteria, whereas the control area displays the current die coordinates, the die pass/fail status and the current running summary, including the count and percentage of sorted die of the wafer. During this process, the prober supplies the x and y coordinates of the die, with the tester suppling the pass/fail sort and soft bins to the application.

The automatic mode causes the Wafermap to become a slave application to the tester and selected device program. This means the user has control from their device program for determining the sort criteria for the pass/fail decisions, whereas the tester supplies the start test, end of test, and the individual wafer summary to the feature.

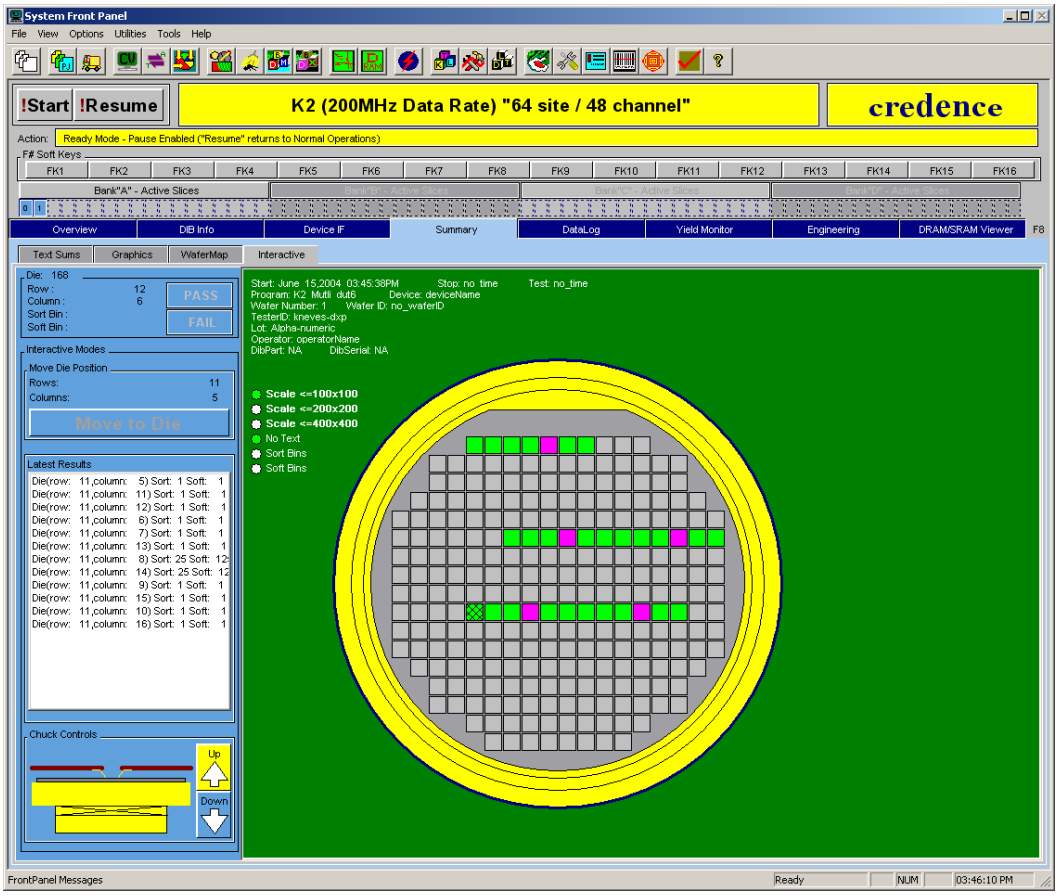
Interactive Wafermap

Interactive Wafermap allows users to interact with problem wafers, for example, low or zero yield or excessive fails. Interactive Wafermap provides control of the prober to move over and pause on a particular die for further examination (click on the die to stop production). Three conditions must be met in order to use Interactive Wafermap:

1. The *.ini file must have PP_INTERACTWMAP enabled in Front Panel.
   a. In the Kalos binary files (release tree) search for FrntPanel.ini.
   b. Bring up an editor to open the file (suggested Notepad).
   c. Change the PP_INTERACTWMAP to *enabled* (the default is disabled).
2. Engineering environment must be enabled (login required).
3. Users must *Start* the program by way of *.dll, then activate the *Pause* operation (either from DeviceIf or Summary Wafermap property page).

NOTE — Loaded *.dll controls messaging and operations to the prober (Chuckup, Chuckdown, and MoveDie).

Figure 94. Interactive Wafermap



ASCII or Graphical Operations

Wafermap can be output either in an ASCII format or a screen capture. The entire screen or a specified region of the window can be selected and captured to the clip board. Images must be pasted to a separate application, such as Paint. The ASCII output can be directed to a line printer or saved as a file.

Summary File Examples

The following are examples of an individual summary file and a composite file printout.

Kalos 2 Summary File - Example Printout

```
Kalos Summary
Tester ID: ccastaldi     Date: September 17,1998 07:29AM
Program: lkg_b1
Device: deviceName
Flow: flow
Lot: Alpha-numeric
```

```
Operator: operatorName
Comment: ..comment..
Users_C: ..user message..
Tested:     136   Passed:     136     100.00   Failed:       0
0.00
```

Categories

```
Sort#      K00    K02     Totals  Percent
    1P      35     21 =       56    41.18
    2P      07     00 =       07     5.15
    4P      26     00 =       26    19.12
    6P      00     47 =       47    34.56
Soft#      K00    K02     Totals
   11       35     21 =       56
   12       07     00 =       07
   14       26     00 =       26
   16       00     47 =       47
End
```

DataLog

The DataLog control application supplies a basic interface for printout of the current datalog (Print... button), and for setting up options.

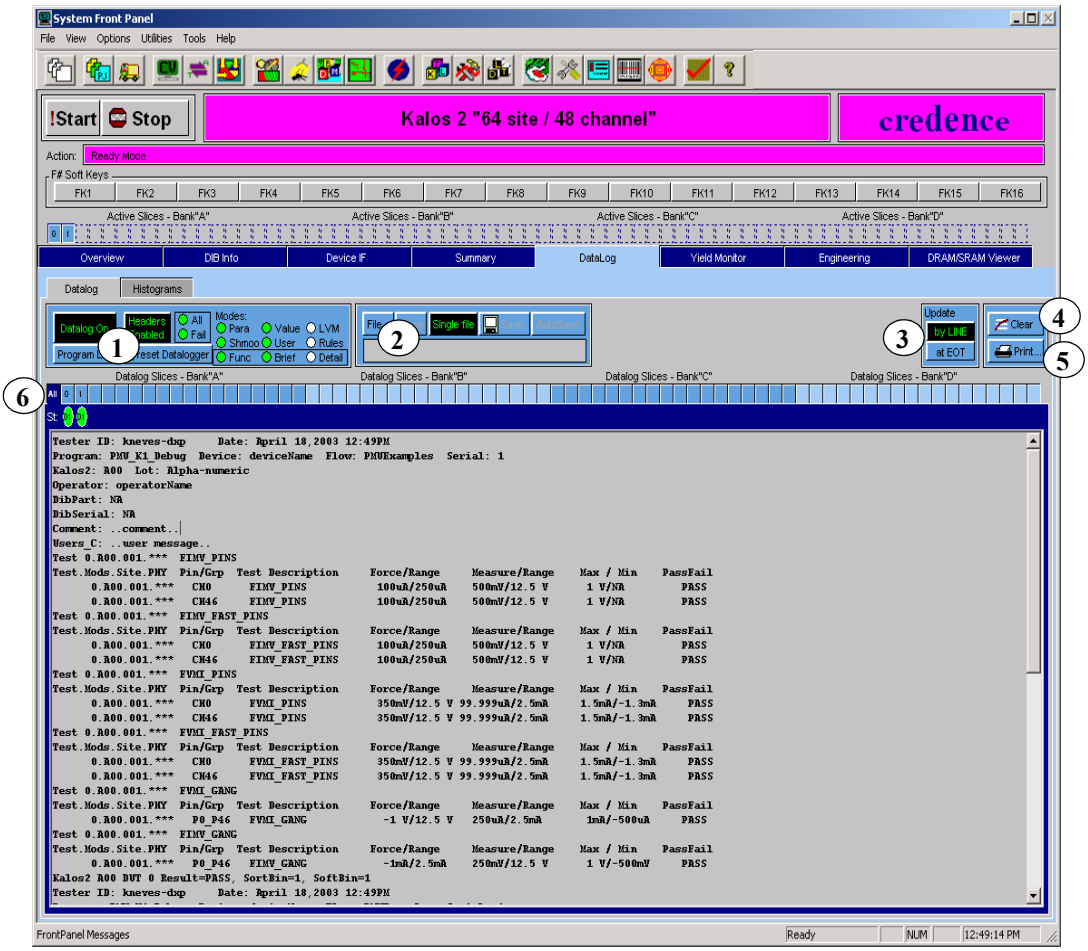
The Datalog application is a viewer that displays the current datalogging results and histogram for DC parametrics, Valuelog, and judge tests (a result from C-Hook pass/fail TPE). Basic features of the application include:

- Kalos formatted text table and result text table with Kalos slice selections for individual and/or composite datalogging viewing.
- Datalog mode controls.
- File management for ASCII text output file with either format.

The *Datalog* property page provides a basic interface for getting the current datalog results for the selected Kalos slice (see Figure 95). The following identifies the numbered sections:

1. Specifics control and mode selection.
2. Datalog file manager (save, save as, close).
3. Update the current datalogging (by line or at the end of testing).
4. Clear (erases) any information currently displayed in the window.
5. Print specifications.
6. Selection for datalog slice viewing.

Figure 95. Datalog Property Page


System Front Panel
File View Options Utilities Tools Help
!Start Stop
Kalos 2 "64 site / 48 channel"
credence
Action: Ready Mode
F# Soft Keys
FK1 FK2 FK3 FK4 FK5 FK6 FK7 FK8 FK9 FK10 FK11 FK12 FK13 FK14 FK15 FK16
Active Slices - Bank"A"
Active Slices - Bank"B"
Active Slices - Bank"C"
Active Slices - Bank"D"
Overview DIB Info Device IF Summary DataLog Yield Monitor Engineering DRAM/SRAM Viewer
Datalog Histograms
Datalog On
Headers Enabled
All Fail
Modes: Para Value LVM Shmoo User Rules Func Brief Detail
Program Reset Datalogger
File
Single file
Update by LINE at EOT
Clear
Print...
1
2
3
4
5
6
Datalog Slices - Bank"A"
Datalog Slices - Bank"B"
Datalog Slices - Bank"C"
Datalog Slices - Bank"D"
Tester ID: kneves-dxp Date: April 18,2003 12:49PM
Program: PMU_K1_Debug Device: deviceName Flow: PMUExamples Serial: 1
Kalos2: A00 Lot: Alpha-numeric
Operator: operatorName
DibPart: NA
DibSerial: NA
Comment: ..comment..
Users_C: ..user message..
Test 0.A00.001.*** FIMV_PINS
Test.Mods.Site.PHY Pin/Grp Test Description Force/Range Measure/Range Max / Min PassFail
0.A00.001.*** CH0 FIMV_PINS 100uA/250uA 500mV/12.5 V 1 V/NA PASS
0.A00.001.*** CH46 FIMV_PINS 100uA/250uA 500mV/12.5 V 1 V/NA PASS
Test 0.A00.001.*** FIMV_FAST_PINS
Test.Mods.Site.PHY Pin/Grp Test Description Force/Range Measure/Range Max / Min PassFail
0.A00.001.*** CH0 FIMV_FAST_PINS 100uA/250uA 500mV/12.5 V 1 V/NA PASS
0.A00.001.*** CH46 FIMV_FAST_PINS 100uA/250uA 500mV/12.5 V 1 V/NA PASS
Test 0.A00.001.*** FVMI_PINS
Test.Mods.Site.PHY Pin/Grp Test Description Force/Range Measure/Range Max / Min PassFail
0.A00.001.*** CH0 FVMI_PINS 350mV/12.5 V 99.999uA/2.5mA 1.5mA/-1.3mA PASS
0.A00.001.*** CH46 FVMI_PINS 350mV/12.5 V 99.999uA/2.5mA 1.5mA/-1.3mA PASS
Test 0.A00.001.*** FVMI_FAST_PINS
Test.Mods.Site.PHY Pin/Grp Test Description Force/Range Measure/Range Max / Min PassFail
0.A00.001.*** CH0 FVMI_FAST_PINS 350mV/12.5 V 99.999uA/2.5mA 1.5mA/-1.3mA PASS
0.A00.001.*** CH46 FVMI_FAST_PINS 350mV/12.5 V 99.999uA/2.5mA 1.5mA/-1.3mA PASS
Test 0.A00.001.*** FVMI_GANG
Test.Mods.Site.PHY Pin/Grp Test Description Force/Range Measure/Range Max / Min PassFail
0.A00.001.*** P0_P46 FVMI_GANG -1 V/12.5 V 250uA/2.5mA 1mA/-500uA PASS
Test 0.A00.001.*** FIMV_GANG
Test.Mods.Site.PHY Pin/Grp Test Description Force/Range Measure/Range Max / Min PassFail
0.A00.001.*** P0_P46 FIMV_GANG -1mA/2.5mA 250mV/12.5 V 1 V/-500mV PASS
Kalos2 A00 DUT 0 Result=PASS, SortBin=1, SoftBin=1
Tester ID: kneves-dxp Date: April 18,2003 12:49PM
FrontPanel Messages
Ready
NUM
12:49:14 PM

The following describes all datalog control area options, shown in Figure 95:

Datalog formatting:

Datalog On/Off — Enable / disabling of datalog.

Headers Enable — Test Headers (enable / disable).

All/Fail — Selection mode All (P/F) tests or Fail tests only.

Program Loading, reset Datalogger — Option (Engineering mode only) for user selection for disabling datalog resetting on next program load.

Modes:

Para — Parametric (analog) tests -

		Shows all parametric test and results.
	Shmoo	Shows the Inline shmoo from the KTL on the ASCII datalogger
	Value	Value Log tests (AC testing) - Shows Value Log from the KTL on the ASCII datalogger.
	User	User defined (TPEprint) - Allows the user to control the TPE function for the datalogger.
	LVM	Allows the user to view Linear Vector Memory (LVM) datalog outputs.
	Rules	Allows the user to view Rules check violations (program versus system resources).
	Func	Functional tests - Shows all functional tests and results.
	Brief	Cells of the TG field show only pass (P) or Fail (F) states.
	Detail	Shows detailed information on the states of pins.

Datalog File manager:		
	Files...	Launches the Save As dialog to open or save files. Enables the following functions:
	Close	Closes the file manager.
	Single file	Toggles between Single file or Multi-files. Single file combines datalogs into a single file. Multi-files are per Kalos 2 slice.
	Save	Send current dialog to the open file. User interaction (manual mode) to save

		datalog data.
	AutoSave	Send current data to the end of the current test sequence.
Update:		
	by LINE	Displays by line, as received, updated datalog information.
	at EOT	Displays updated information at End-of-Test (EOT).
Clear	Erases any information currently displayed in the window.	
Print...	Generates a hard copy of the current datalog and sends it to the selected printer.	
Datalog Slices	Select datalog display. All means every slice is enabled. Selecting the Kalos 2 slice number displays only datalog results.	

The *Print...* button launches the dialog window for controlling properties, printer selection, and the number of copies. The data sent is the data currently displayed in the Datalog Slices - Bank “#”.

The datalog slice(s) file manager is activated by clicking *File...*, which launches the Save As dialog window for opening a new file or save an open file. The directory path name is included with this operation. The lower text field, if a file is opened, displays the filename. Two modes are available: Save and Automatic.

- Save mode allows the user to manually send the current datalog to the open file (Adds to the file; does not overwrite).
- AutoSave mode sends the data to the file at the end of the current test sequence.

Format selection is only active when the Datalog On button is highlighted in green. Current formats are Trace mode, which allows the user to view the executing flow with test headers only, (all modes are disabled and the All/Fail check boxes are enabled) and Para. All other selections are derived from this format. Refer to the Datalog Formatting Modes section above for a description of each available mode.

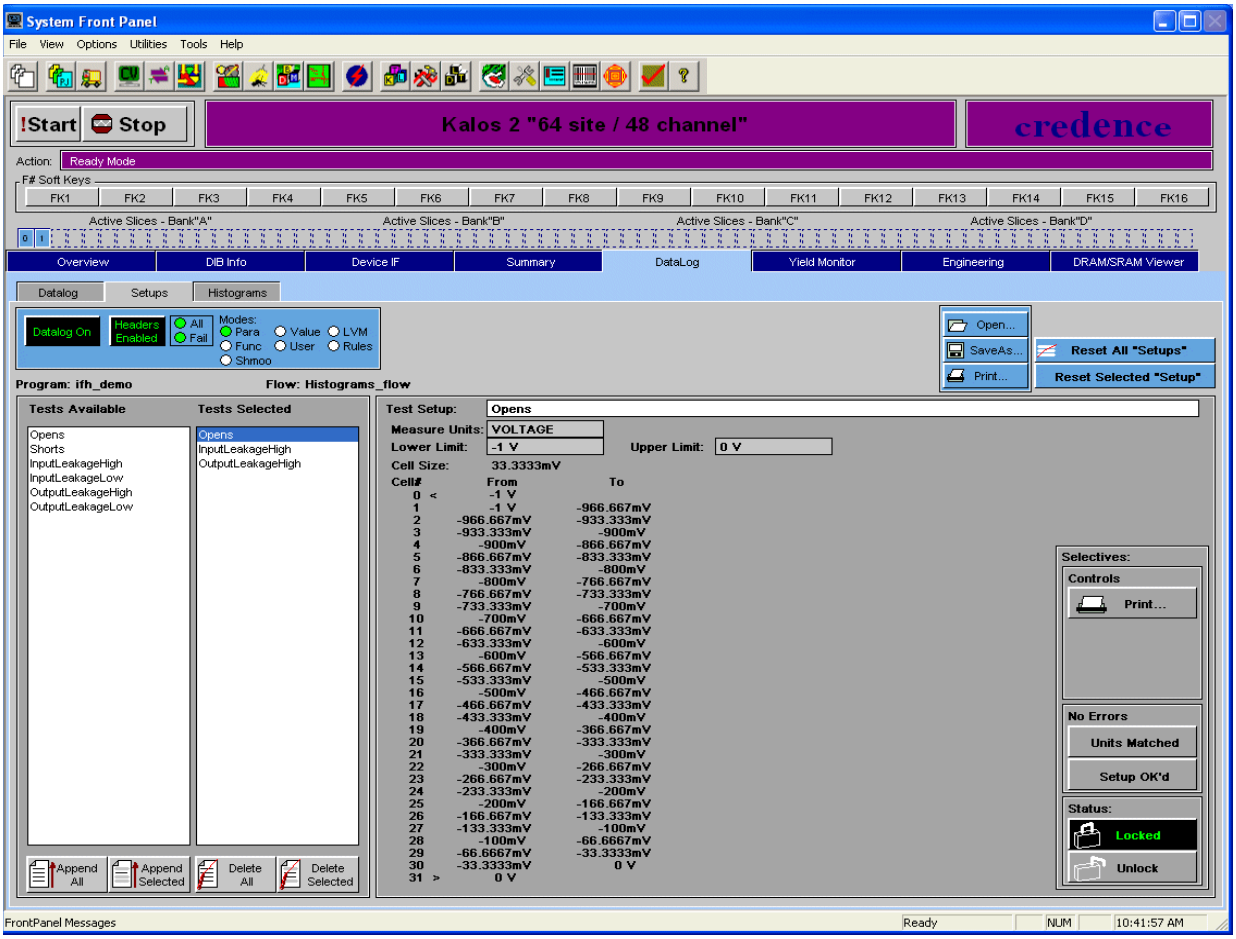
The Clear operation erases all datalog slice(s) information. This deletes the current datalog data (All Slices) and defaults to the header information only. The cleared data is not retrievable.

The Datalog Active Slices tabs section allow the selection of which datalogging results are displayed. In Figure 95, “All” active slices are collected, and data results are displayed in the background.

Setups Property Page

The Setups property page of the Datalog application is used to program the parameters display of the Histograms property page (see Figure 96).

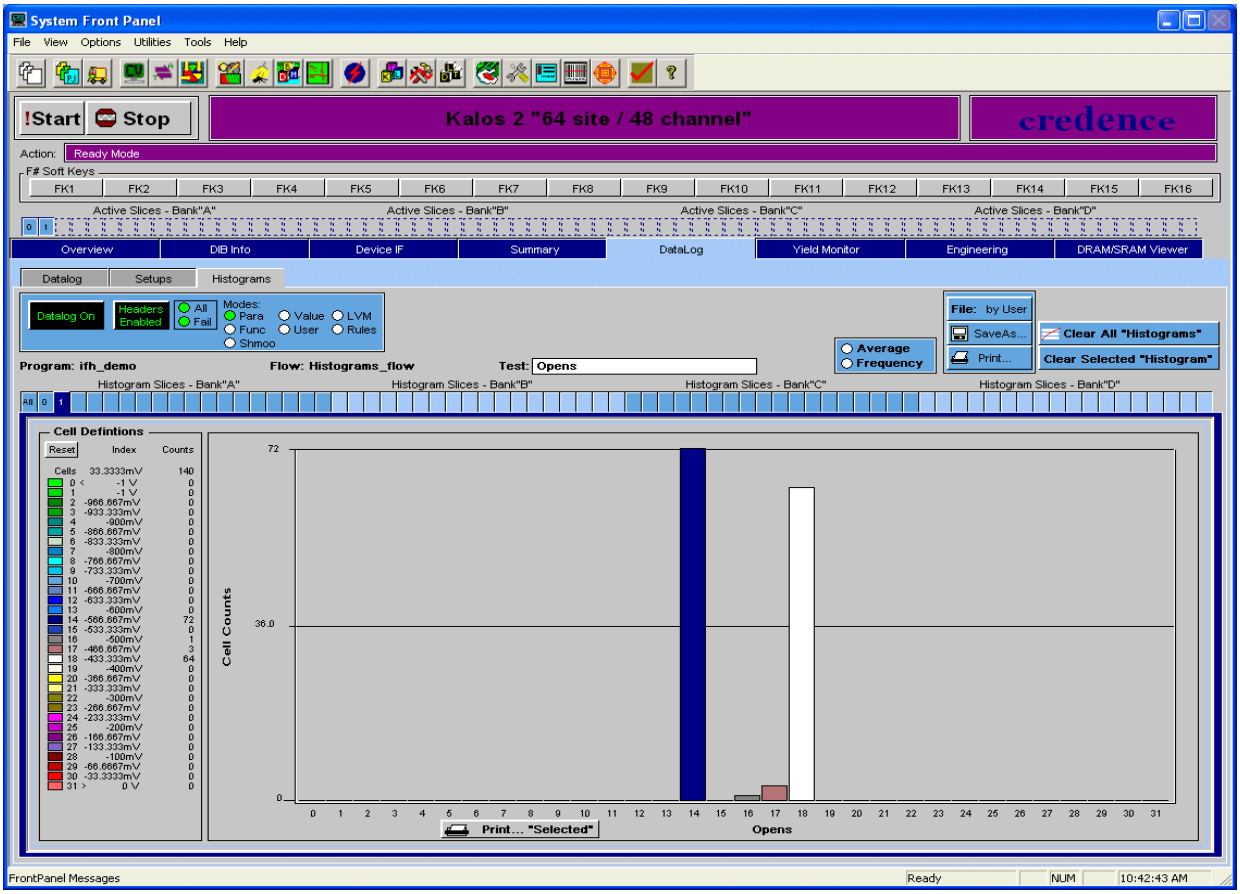
Figure 96. DataLog Property Page: Setups



Histogram Property Page

The Histogram property page of the Datalog application displays the results of the chosen parametric test. The results are also based on the limits programmed on the Datalog Setups property page.

Figure 97. Datalog Property Page: Histograms



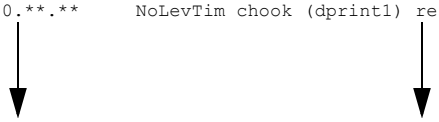
NOTE — You cannot change formats with the ASCII Datalogger. The Datalog saves by events or by slice.

Example Printout of a Datalog File

The following is an example of a datalog file printout.

```
Tester ID: op-id     Date: July 31,1999 08:46AM
Program: program_name  Device: device_type  Flow: flow_name  Serial: 5
Kalos: 0  Lot: Alpha-numeric
Operator: user_name
Comment: ..comment..
Users_C: ..user message..
Test 100.00.01.**  Contact
     100.00.**.**     Contact chook (dprint1) result message!
Test.Mdl.Site.PS  Pin/Grp  Test Description     Force/Range     Measure/Range    Max / Min    Pass-
Fail
    100.00.01.**   A0       Contact            -100uA/250uA   -500mV/12.5 V       NA/-1 V       PASS
    100.00.01.**   A1       Contact             -100uA/250uA   -500mV/12.5 V       NA/-1 V       PASS
```

```
    100.00.01.**   OE_      Contact            -100uA/250uA   -500mV/12.5 V       NA/-1 V       PASS
    100.00.01.**   WE_      Contact            -100uA/250uA   -500mV/12.5 V       NA/-1 V       PASS
Test 133.00.01.**  NoLevTim
     133.00.**.**     NoLevTim chook (dprint1) result message!
```



```
est.Mdl.Site.PS  Pin/Grp  Test Description     Force/Range     Measure/Range    Max / Min    PassFail
    300.00.01.**   ABUS     InputLeakageHigh   5.5 V/12.5 V     0 A/25uA       1uA/-1uA       PASS
Test 400.00.01.**  InputLeakageLow
Test.Mdl.Site.PS  Pin/Grp  Test Description    Force/Range     Measure/Range    Max / Min    PassFail
    400.00.01.**   ABUS     InputLeakageLow      0 V/12.5 V     0 A/25uA       1uA/-1uA       PASS
Test 500.00.01.**  OutputLeakageHigh
Test.Mdl.Site.PS  Pin/Grp  Test Description    Force/Range     Measure/Range    Max / Min    PassFail
    500.00.01.**   DBUS     OutputLeakageHigh   5.5 V/12.5 V     0 A/25uA       11uA/-11uA      PASS
Test 600.00.01.**  OutputLeakageLow
Test.Mdl.Site.PS  Pin/Grp  Test Description    Force/Range     Measure/Range    Max / Min    PassFail
    600.00.01.**   DBUS     OutputLeakageLow      0 V/12.5 V     0 A/25uA       11uA/-11uA      PASS
Test 700.00.01.**  rdarrayff_Test
Test 750.00.01.**  rdarrayff_LOOP
Test.Mdl.Site.PS  Test Description  Cycle_Count  CntrA(0x Z.Y.X)  CntrB(0x Z.Y.X)  CntrC(0x Z.Y.X)
Pass/Fail
   750.00.01.** rdarrayff_LOOP   0x00000000  0x00.0000.0000  0x00.0000.0000  0x00.0000.0000
PASS
Test 800.00.01.**  erase_device
Test 810.00.01.**  erase_LOOP
Test.Mdl.Site.PS  Test Description  Mem_Read IO15 IO14 IO13 IO12 IO11 IO10 IO9  IO8  IO7  IO6  IO5
IO4  IO3  IO2  IO1  IO0
    810.00.01.** erase_LOOP       Fail_Cnt 0    0    0    0    0    0    0    0    0    0    0    0
0    0    0    0
    810.00.01.** erase_LOOP        Exp/Act  0/0  0/0  0/0  0/0  0/0  0/0  0/0  0/0  0/0  0/0  0/0
0/0  0/0  0/0  0/0  0/0
Test.Mdl.Site.PS  Test Description  Cycle_Count  CntrA(0x Z.Y.X)  CntrB(0x Z.Y.X)  CntrC(0x Z.Y.X)
Pass/Fail
   810.00.01.** erase_LOOP      0x00000000  0x00.0000.0000  0x00.0000.0000  0x00.0000.0000
PASS
Test 900.00.01.**  wrt55_Test
Test 950.00.01.**  wrt55_LOOP
Test 1000.00.01.**  read55_Test
Test 1100.00.01.**  read55_LOOP
```

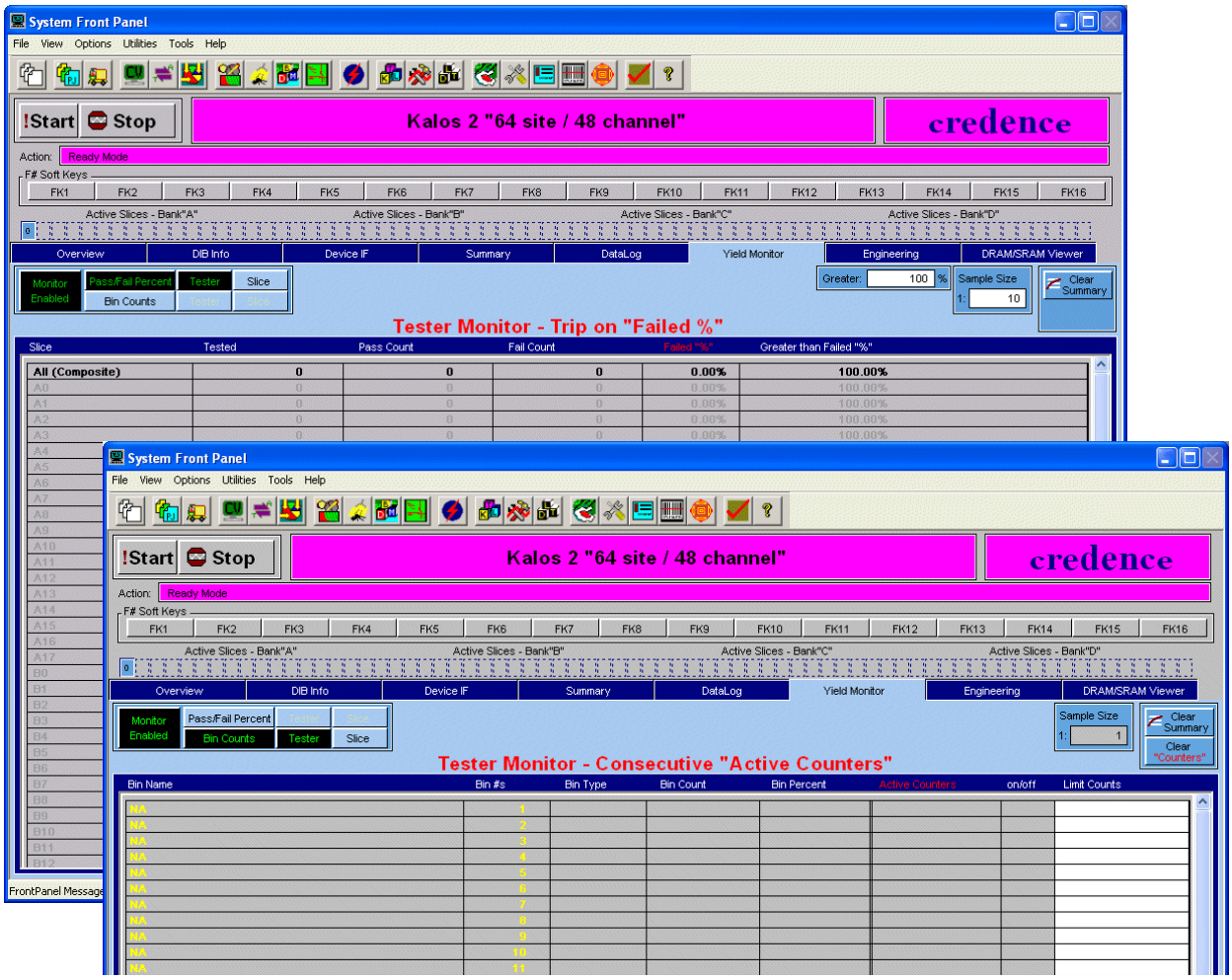
Yield Monitor

Yield Monitor provides an option to stop (yield) the test after a specified pass/fail percentage or bin count is reached on each Kalos 2 slice. This option can be used during production to monitor yield and stop the test if failures or bin counts go beyond a predefined percentage. For example, if the probe card develops an open pin, Yield Monitor can be configured to stop the test before the entire lot is tested (see Figure 98).

The following setting options are available on the Yield Monitor property page:

Monitor	Disabled / Enabled - Toggles to turn Yield Monitor off/on.
Type	Pass/Fail Percent - Select to stop test based on total yield failures of tester or module (next two buttons). Bin Counts - Select to stop test based on total failures of a particular bin. (In Kalos versions 1.8.8 and higher, this can be selected for the Tester only, not per module.)
Sample Size	Select to sample yield every nth die. For example, sample size = 1:10. This means sample every 10th die to check yield.
Greater	Percentage % - Pass/Fail percent mode. The tester stops when the percentage of fails is greater than the number entered here.
Module	Module number or All (composite).
Tested	Total number of devices tested.
Pass Count	Total number of devices that passed.
Fail Count	Total number of devices that failed.
Failed %	Percentage of fails.
Greater than Failed %	Fail percentage greater than the number entered.

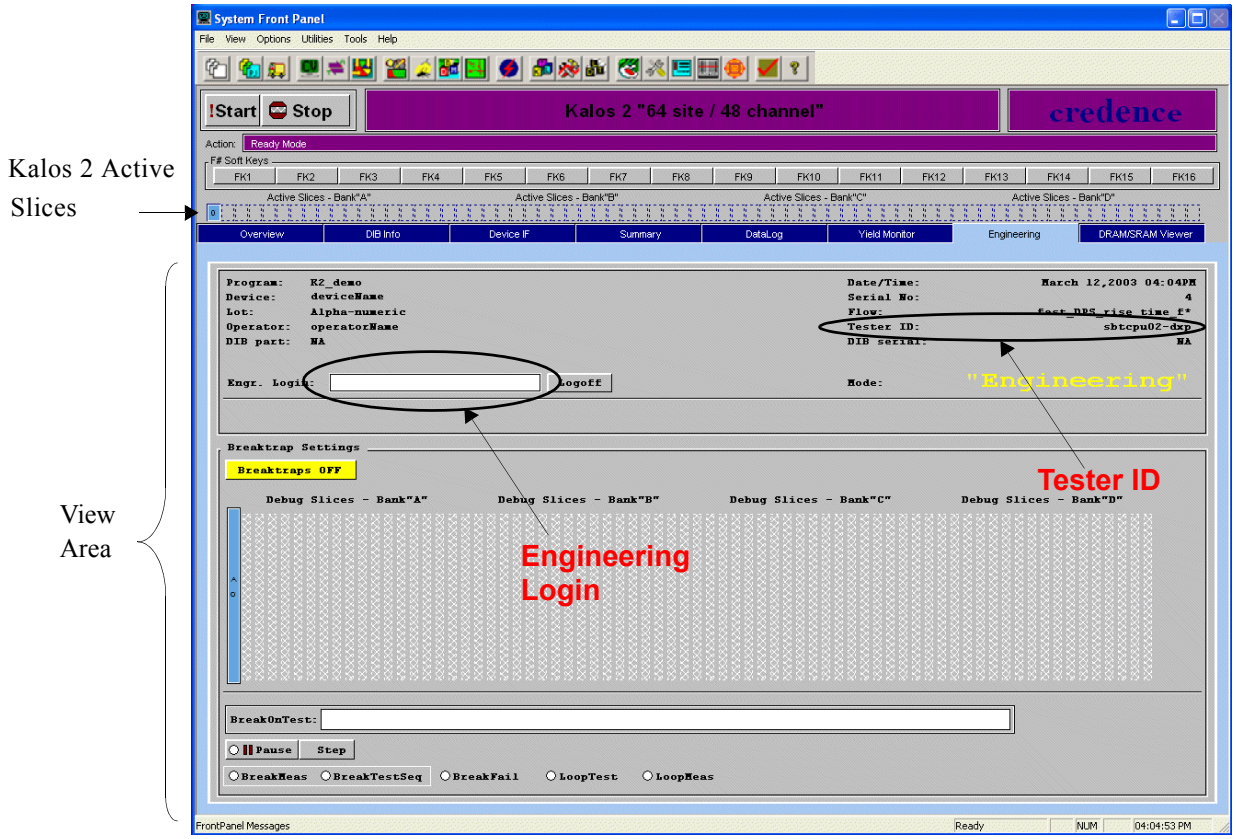
Figure 98. Yield Monitor Property Page


System Front Panel
File View Options Utilities Tools Help
!Start Stop
Kalos 2 "64 site / 48 channel"
credence
Action: Ready Mode
F# Soft Keys
FK1 FK2 FK3 FK4 FK5 FK6 FK7 FK8 FK9 FK10 FK11 FK12 FK13 FK14 FK15 FK16
Active Slices - Bank"A"
Active Slices - Bank"B"
Active Slices - Bank"C"
Active Slices - Bank"D"
Overview DIB Info Device IF Summary DataLog Yield Monitor Engineering DRAM/SRAM Viewer
Monitor Enabled
Pass/Fail Percent
Bin Counts
Tester
Slice
Greater: 100 %
Sample Size 1: 10
Clear Summary
Tester Monitor - Trip on "Failed %"
Slice Tested Pass Count Fail Count Failed "%" Greater than Failed "%"
All (Composite) 0 0 0 0.00% 100.00%
FrontPanel Messages
System Front Panel
File View Options Utilities Tools Help
!Start Stop
Kalos 2 "64 site / 48 channel"
credence
Action: Ready Mode
F# Soft Keys
FK1 FK2 FK3 FK4 FK5 FK6 FK7 FK8 FK9 FK10 FK11 FK12 FK13 FK14 FK15 FK16
Active Slices - Bank"A"
Active Slices - Bank"B"
Active Slices - Bank"C"
Active Slices - Bank"D"
Overview DIB Info Device IF Summary DataLog Yield Monitor Engineering DRAM/SRAM Viewer
Monitor Enabled
Pass/Fail Percent
Bin Counts
Tester
Slice
Sample Size 1: 1
Clear Summary
Clear "Counters"
Tester Monitor - Consecutive "Active Counters"
Bin Name Bin #s Bin Type Bin Count Bin Percent Active Counters on/off Limit Counts

Engineering

Engineering application Engineering modes (non-production) is used to login and enable all tools and utilities (see Figure 99). When in production mode Shmoo Plot-PinMonitor-Value Log, Bitmap, Test Bugger, DBM Editor, ShowBitz, Cal/Diag, IDRom, NVMDIB, and Kalos 2 Editor are disabled (grayed areas). Users must log on by way of the Engineering property page to enable these tools and utilities. To login, enter the password into the Password field then press the Tab key. This enables the Engineering application mode. The default password used to login is the Tester ID: *Name* that appears on the Engineering property page header.

Figure 99. Engineering Property Page



The Kalos 2 Active Slices boxes (see Figure 99) are located on the Front Panel window. A box representing each board slice in the test head is reflected.

The top section of the view area displays the header information for the current test program. Header information can only be changed from the Overview property page (from any user application). Or the information can be changed from the loaded *.ktl program and the loaded *.DLL Device IF.

Breaktrap Settings

Breaktrap setting operations are available under the Engineering property page. Breaktrap settings are conditions set by the user to configure the Kalos 2 system to specific requirements prior to executing a test flow.

Once the user has selected the desired Kalos 2 module to *Breaktrap on*, one of the following available Breaktrap settings can be chosen:

Pause / Step — When the *Pause / Step* Breaktrap is set, the user can step through each action item in a test.

BreakMeas	When *BreakMeas* is set on a selected test/measurement, the program executes all tests in the flow up to and including the selected test, then waits for the user to click on the Start or Stop button or launch Kalos 2 application/debugging tools, such as Shmoo, Test Debugger, and ShowBitz.
BreakTestSeq	Allows the entire selected test sequence to execute. This is used with the cell current measure feature of the Bitmap tool which allows the user to run a setup pattern.
BreakFail	*BreakFail* can be used to detect the first failing test in the test flow. However, after the first failing test is detected, you can manually step through the test flow. After the failing test is displayed in the yellow action field, users can launch the ShowBitz utility to modify the current settings, such as, voltage levels.
LoopTest	*LoopTest Breaktrap* is useful when examining signals on the oscilloscope. While looping on a test, the user can launch the Test Debugger application to modify DPS, Levels, and Timings value on-the-fly.
LoopMeas	*LoopMeas Breaktrap* is useful when examining signals on the oscilloscope. While looping on a measurement, the user can launch the Test Debugger application to modify DPS, Levels, and Timings values on-the-fly.

NOTE — You can only debug one module at a time. Choose the module by clicking on the module you wish to debug under Debug Module in the Breaktrap Settings area on this property page.

Implementation

Following is the definition of the Breaktrap Settings, as defined by the Kalos 2 Test System:

Test	The execution of each item in its SEQUENCE.
Measurement	1. A measurement taken on one of the power supplies or the parametric measurement unit: MEAS (VCC0 I VCC1 I VPP0 I VPP1 I PMU) or 2. The execution of a pattern burst: PG_RUN ( ).
FAIL	Fail of a measurement. Note: There could be more than one measurement in a test SEQUENCE.

Step — Sequentially execute every action item (resource statement, C-function, etc.) in its SEQUENCE upon pressing the *Start* button. To enable the Step Breaktrap Setting, the *Pause* button must first be selected.

Once *BreakMeas* is set on a selected test/measurement, the program executes all tests in the flow up to and including the selected test, then waits for the user to click on the *Start* or *Stop* button or launch Kalos 2 application/debugging tools, such as Shmoo, Test Debugger, and ShowBitz.

If the user executes a shmoo plot, every data point on the plot is the result of running the selected breaktrap/measurement. The Test Debugger tool reads the current test components and allows viewing and modification of them. ShowBitz displays and allows modification of the contents of all hardware registers in the Kalos 2 system. Refer to the Test Debugger chapter in this manual for additional information on break test settings.

DBM/SRAM Viewer in Front Panel

All DBM and LVM data in a test program is stored in the tester DRAM. At program load time, the SRAM contains the last data loaded into it, in the order it occurs, in the test program. At test program runtime, the SRAM is updated from the DRAM by the test program itself when a DBM or pattern resource name occurs as a SEQUENCE action. The Redundancy Analysis function may also save and restore the SRAM from DRAM. The smallest unit of storage used in the DRAM is one row, which is 288 bits of data. The SRAM is also composed of rows of 288 bits of data. When the DUT width is a power of 2, from 1 to 32, only the first 256 bits of data in a row are used. The upper 32 bits of these rows are ignored.

NOTE — Although each DRAM entry has a fixed and re-locatable component, at times the fixed component may be used for re-locatable data. In this case, the fixed descriptors represent re-locatable values. Look for RELOC to appear for both MEM_A and MEM_B to indicate this usage.

The DRAM/SRAM Viewer property page (see Figure 100) lists the entries in the DRAM by filename (the table is updated).

The following provides a description of each column in the DRAM entry.

Filename — Represents either the DBM or pattern filename defined by a test program resource. Only LVM or Scan pattern data is stored in the DRAM. Algorithmic pattern data is stored in the CPU memory on the ETX board.

DRAM fixed offset (fixed size) — The fixed offset is used for DBM or Scan data that always starts at a fixed address in the SRAM. The fixed size is count of rows allocated in the DRAM.

DRAM reloc offset (reloc size)

The re-locatable offset is used for LVM data that can have any starting address in the SRAM. The reloc size is count of rows allocated in the DRAM.

SRAM fixed offset (reloc offset)

Since each entry in this view can have both a fixed and re-locatable component, the offset to the start row of fixed component appears first, followed by the start row of the re-locatable component in parentheses. Unused components have a default value of 0. Refer to the SRAM Status to determine whether a component is in use.

SRAM Status — This field reports the type of components in this entry. The value may be RELOC and/or FIXED. If this entry is not currently in the SRAM, the status is filled with dashes (-------).

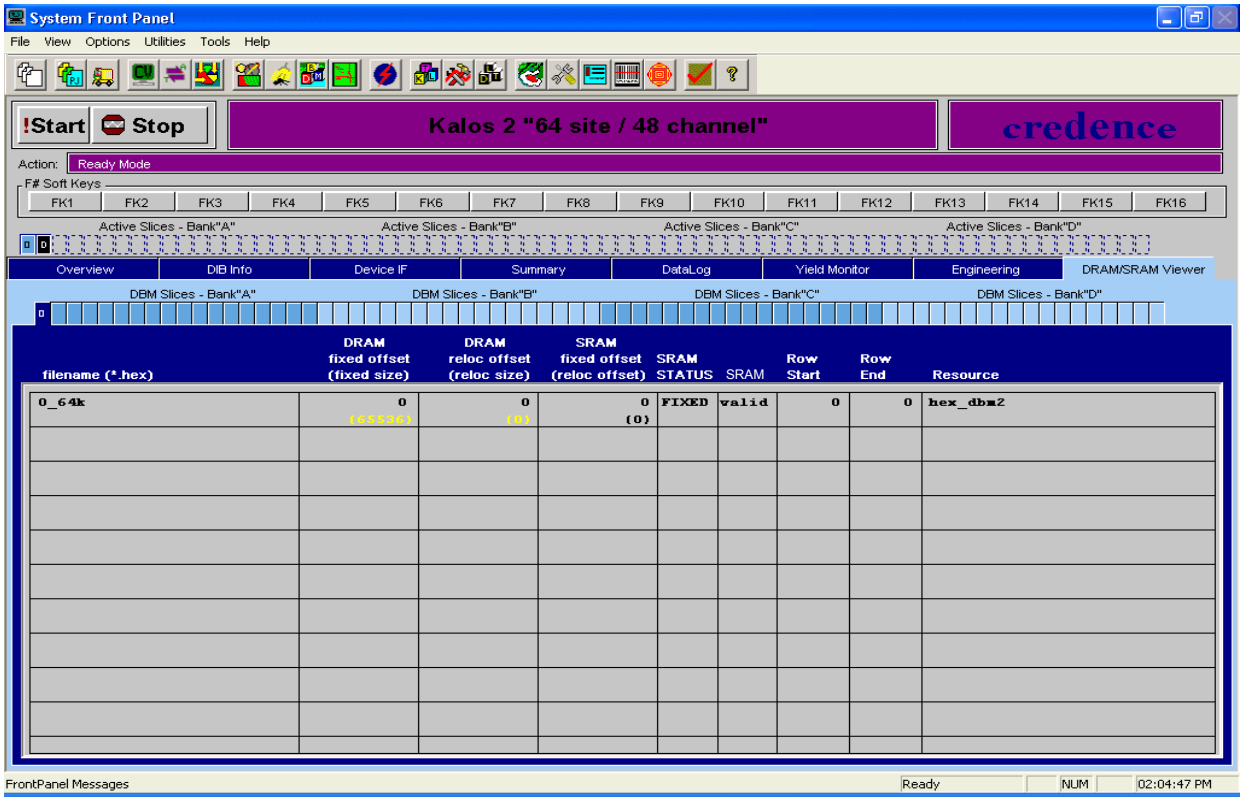
SRAM — This field reports the SRAM assigned to the fixed and/or reloc components in this entry. The value may be MEM_A, MEM_B or BOTH, where BOTH indicates the two memory fields are combined into one. BOTH occur only in the single slice configuration of 48 channels. The two-slice configuration of 96 channels always has SRAMs MEM_A and MEM_B.

Row Start — Depending upon the organization of DUT data in the SRAM rows, partial SRAM rows may result. Row start represents the first bit of the first row of this entry at which to start. Zero (0) indicates starting at the first bit in the row.

Row End — Depending upon the organization of DUT data in the SRAM rows, partial SRAM rows may result. Row end represents the last bit of the last row of this entry to which it ends. Zero (0) indicates ending at the last bit in the row.

Resource — This field is the test program resource name that defined this entry.

Figure 100. DBM/SRAM Viewer



History RAM Control

The history RAM is a 64 location deep memory that is capable of storing nearly the entire state of the Omni including both the Pattern Generator (PG) subsystem (URAM address, loop counters, and logical address and data), and Timing Generator (TG) subsystem (comparator expect and actual data) at set condition cycles. The primary function of the history RAM is to improve datalogging. This means:

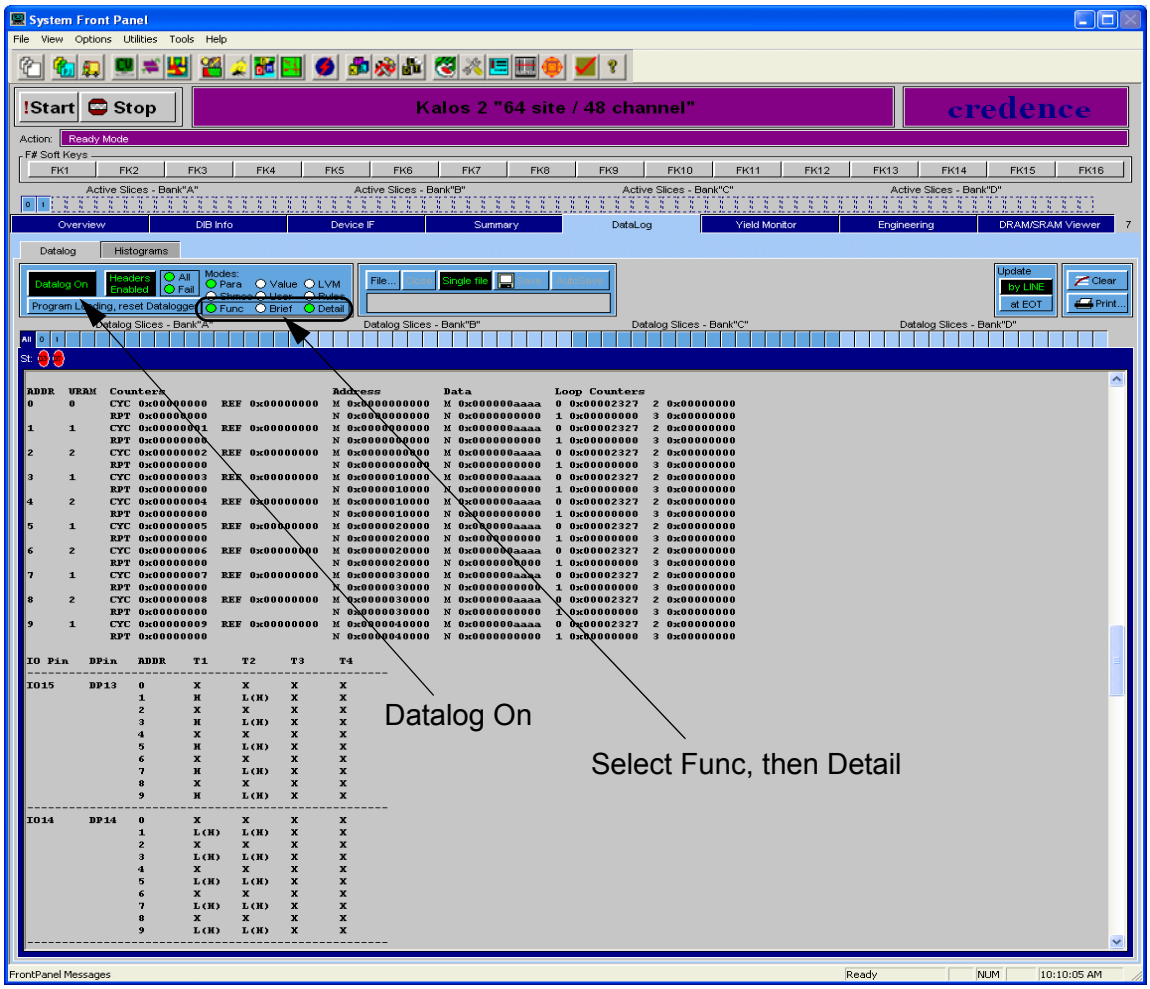
- More complete datalog information is available.
- Improved programmability when selecting windows and cycles.
- Relevant values are contained for DUT-time rather than terminal values at the end of the burst.

The history RAM Control allows users to monitor conditions of the pattern and timing generator at a set condition point within a functional test or a point within a patterns execution.

The History Ram Control is launched by clicking on the KDatalog icon (see Figure 101) on the Front Panel, or it can be launched (selected) from the Datalog property page. If selected from the Datalog property page, ensure that *Datalog On* is highlighted, then select the Func modes option, followed by the *Detail* option, as shown in Figure 102.

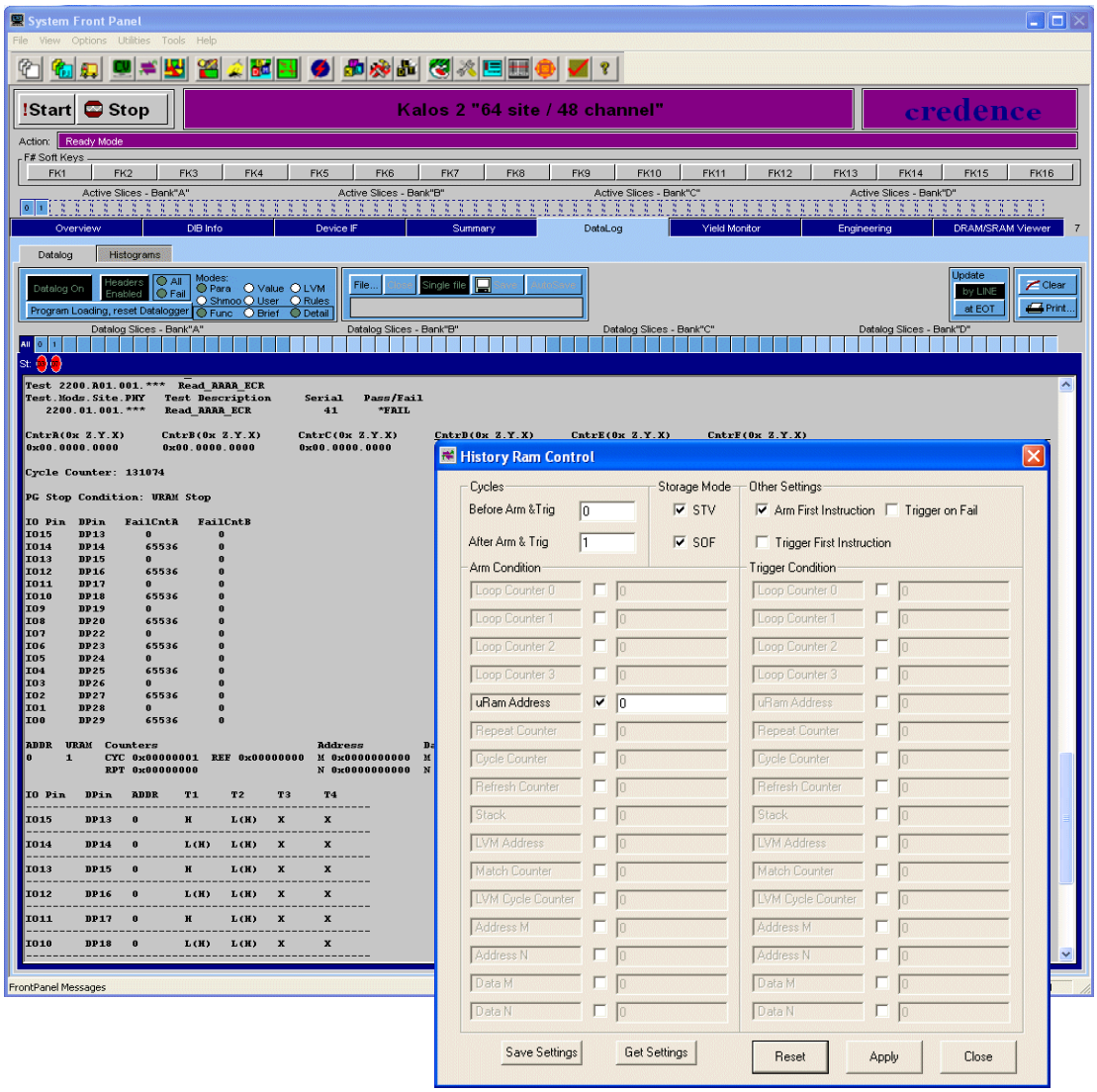
Figure 101. History Ram Control From Front Panel KDatalog Icon

Figure 102. History Ram Control From Datalog Property Page



The History Ram Control window appears, as shown in Figure 103.

Figure 103. History Ram Control Window



History RAM Theory

The History Ram is a 64-location memory which stores various Omni central and channel resources including the observed responses of the DUT.

The memory wraps around when the maximum storage is exceeded. When the store-this-vector and store-on-fail storage modes are not enabled, the History Ram stores data on every cycle until an arm and trigger condition is met, then stops after the selected number of cycles in stop cycle counter, or the Patgen stops. Various conditions can be set to arm and trigger the *stop cycle counter*. An arm event can

occur at the same time as a trigger event or prior to it. Once armed, a trigger event causes the stop cycle counter to count down from its preset value. Upon reaching the terminal count the stop cycle counter inhibits further storage. The stop cycle counter value can be set between 0 and 63. A non-zero value of N allows N more cycles to be stored including the trigger event itself, while a zero prevents any storing.

When the store-this-vector mode is enabled, only cycles which have the URAM bit *STV* set store data into the History Ram. When the store-on-fail mode is enabled, only the cycles that have a strobe fail store data. When both the store-this-vector and store-on-fail modes are enabled, both the STV URAM bit and the strobe fail must be true for storage.

Storage

Stored system resources include:

- Uram Address Counter
- Subroutine Stack Address
- Repeat Counter
- Loop Counters 0, 1, 2, 3
- Match Counter
- Cycle Counter
- Refresh Counter
- Logic Address M, N
- Logic Data M, N
- LVM Address
- LVM Cycle Counter
- Arm Occurred
- Trigger Occurred

Stored channel resources include (either high/low comp glitch or high/low expect data is stored depending on the selection at *db_sel_tg_comp_EXp_data*:

- TG A/B/C/D high comp glitch or high comp expect data
- TG A/B/C/D low comp glitch or low comp expect data
- TG A/B/C/D high comp data
- TG A/B/C/D low comp data
- TG A/B/C/D fail
- TG A/B/C/D strobe on this edge

Arm

When arm first instruction is selected, arm occurs on the first cycle; otherwise, arm occurs when all enabled arm conditions are true.

The following resources can be used to set the condition or conditions for arm:

- Uram Address Counter
- Subroutine Stack Address
- Repeat Counter
- Loop Counters 0, 1, 2, 3
- Match Counter
- Cycle Counter
- Refresh Counter
- Logic Address M, N
- Logic Data M, N
- LVM Address
- LVM Cycle Counter

Trigger

When trigger first instruction is selected, trigger occurs on the first cycle; otherwise, trigger occurs when all enabled trigger conditions are true.

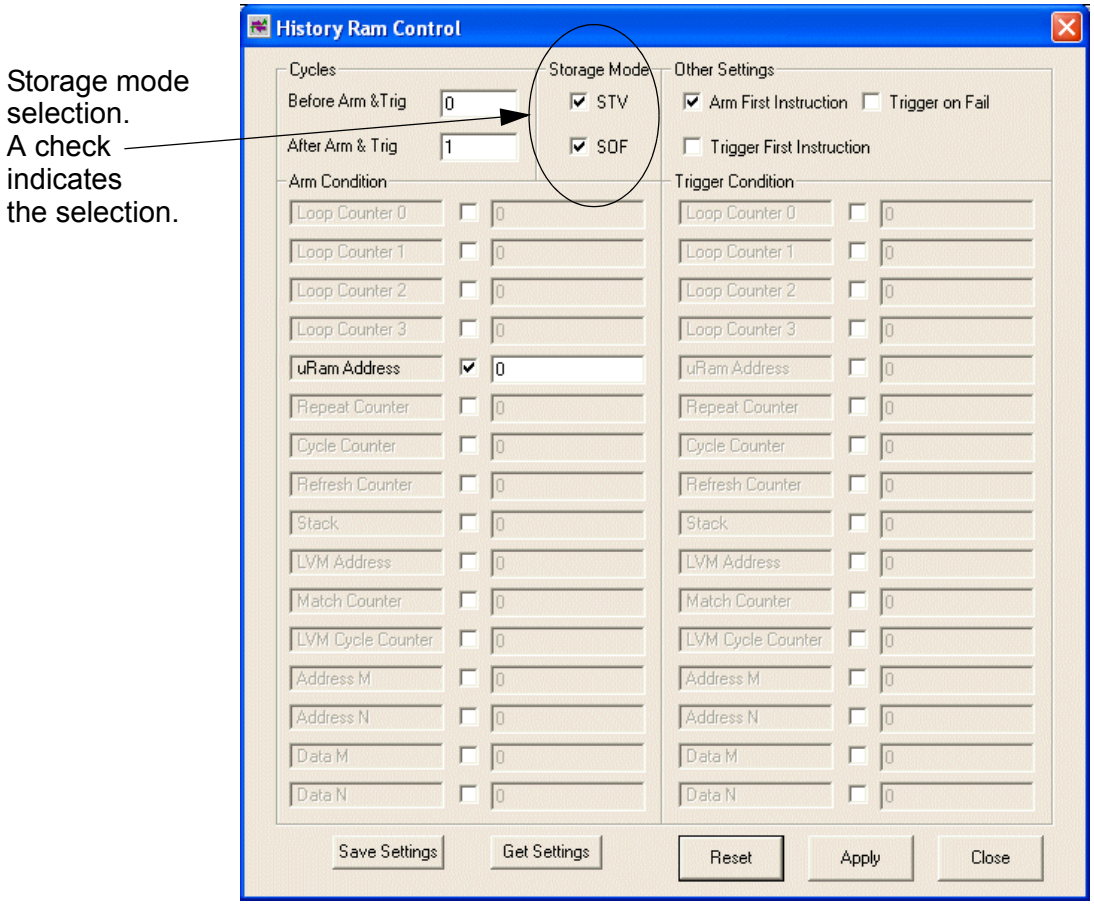
The following resources can be used to set the condition or conditions for trigger:

- Uram Address Counter
- Subroutine Stack Address
- Repeat Counter
- Loop Counters 0, 1, 2, 3
- Match Counter
- Cycle Counter
- Refresh Counter
- Logic Address M, N
- Logic Data M, N
- LVM Address
- LVM Cycle Counter

Synchronized Fail

The History RAM default settings are shown in Figure 104.

Figure 104. History Ram Control Default Settings



NOTE — The settings that are chosen within the History Ram Control popup window affect whatever pattern is currently loaded in the URAM.

The following storage modes of operation are provided by the History Ram Control.

- **Before/After Arm & Trig** - These fields are used to stop storing history RAM data after the specified number of cycles are stored. If the pattern completes before the specified value is reached, only the actual number of cycles stored are available in the history RAM.

  Before Arm & Trigger - Specify the number of cycles to be passed before arm and trigger event (0 to 63). Cycles are stored after all arm conditions are met.

After Arm & Trigger - Specify the number of cycles to be passed after arm and trigger event (0 to 63). The sum of Before and After Arm & Trig must be less then or equal to 64.

- **Store This Vector (STV)** - In this storage mode only test cycles with the Store This Vector (STV) bit enabled are captured in the history RAM. In addition, if the SOF bit described below is set, only STV cycles that fail are stored. This interactive debug feature (or advanced datalogger) allows the user to enable or disable storing of cycles in the pattern that have the STV bit enabled. STV is enabled by default for every cycle in a pattern. Use of the stvOff keyword disables STV for all cycles until the stvOn keyword is specified. These code operations allow the user to specify a block of cycles/vectors that will either be stored (stvOn) or not (stvOff) when the STV control storage mode is selected. Following is an example of stvOn and stvOff fail processor operations.

```
                write_cyc   (stvOn, data = 0xff);

t40us1:         noop1us_cyc ( link cga(x<y)) jump if (loop(0));

                noop_cyc(stvOff , ++cga(x<y)) jump wrt if (loop(1));

                (tset0) stvOn "H0000000000000";

                (tset0) stvOff  "0H00000000000";
```

The stvOff mode may be overridden for a single cycle with the syntax shown below.

```
              write_cyc   (stv, ++cga(x<y), data = 0xff);

              (tset0) repeat 10, stv  "000000000000";
```

- **Store Only Fail (SOF)** - In this storage mode, only tester cycles with a strobe failure are stored. The History RAM can still be armed and triggered; however, only data from fail cycles will exist in the RAM at end of test. This mode allows more fail data to be collected since passing cycles are not stored.
- **Store This Vector and Store Fail Only** - By default both of these storage modes are enabled for Kalos 2. This is a hybrid mode that stores fails only for vectors/cycles with the STV bit set. To facilitate its use, by default all logic vectors and algorithmic pattern instructions have the STV bit set, except conditional fail instructions. Conditional fail instructions are those which jump, increment, or call a subroutine based on whether or not a fail occurs in the kpl. In this mode, it is likely that the user will arm and trigger on first fail since this is the objective of this default.

- **Store All Mode** - All cycles are stored if *neither* STV or SOF modes are chosen in the History Ram Control window. During each tester cycle, all of the PG/TG data for cycles is stored up until an arm and trigger occur, followed by the number of cycles in the Before Arm & Trig field. In this mode, a complete window of execution can be reconstructed around the trigger cycle.

Arm

The arm condition allows users to identify a condition that must occur before the History RAM can trigger. After the arm condition is set, the history RAM stores data until the trigger condition is met. The advantage of having a separate arm capability is to delay the triggering to a URAM or cycle that occurs later during the burst, possibly after many other fails have occurred.

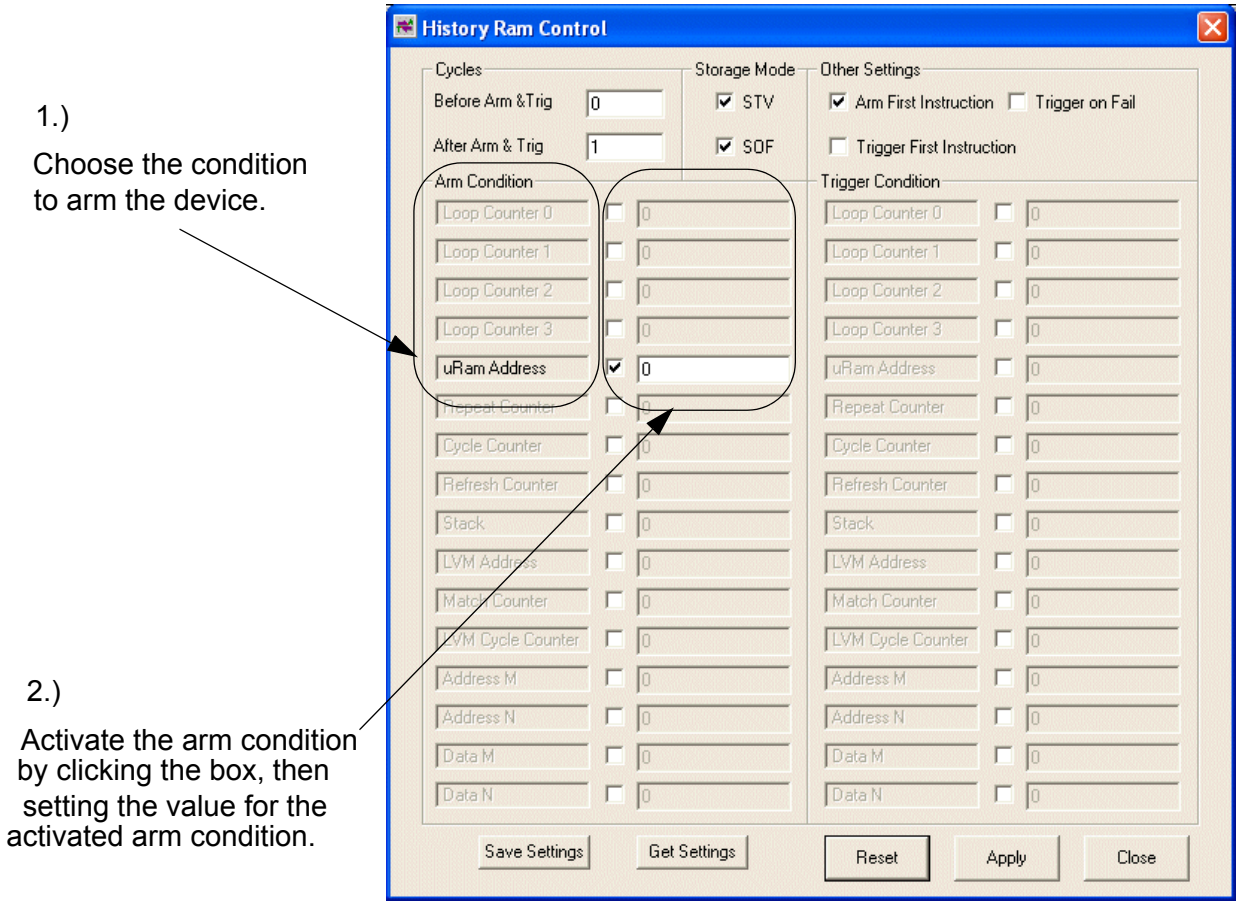
NOTE — Arming on the first cycle and triggering on the first fail is the Kalos 2 default.

The following are conditions that can be used to arm as well as trigger an event:

- A fail occurs
- A URAM address is executed
- Any counter reaches a condition value
- Any combination of the above (logical AND combination)

As shown in Figure 105, users can choose one or more conditions which must be met to set an arm condition.

Figure 105. Setting Arm Conditions



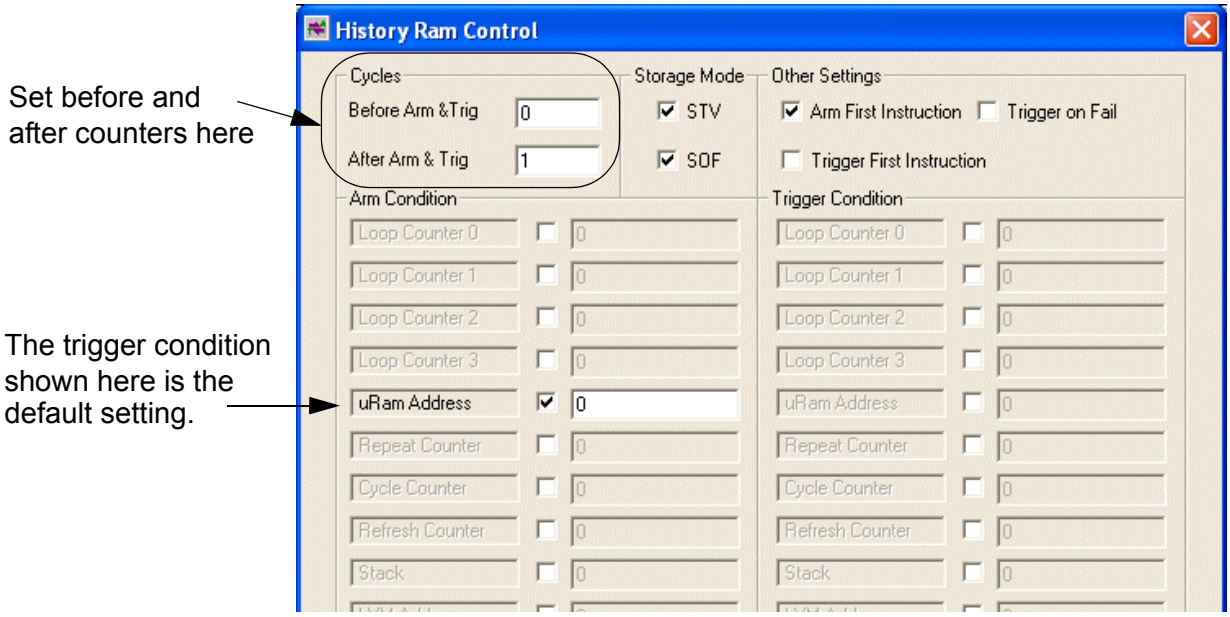
Trigger

Trigger is used to establish what event or condition causes the history RAM to stop storing data after N cycles. The Before/After Arm & Trig in the History Ram Control popup window are used for storing N cycles after triggering the event. For example, setting Before Arm & Trig to 32 cycles of data before the trigger event leaves at most 32 cycles that follow the trigger event. Changing these two values allows the window of 64 cycles around the trigger event to be moved (see Figure 106).

The Apply button applies the settings to the currently loaded pattern. The Reset button resets the History Ram Control to the default settings. Once the settings are made and accepted, the user is prompted to click *OK* in the pop-up window, shown in Figure 107.

NOTE — The window does not allow users to enter a number greater than 63. If the user attempts to enter a number greater than 63 an informative error message is displayed.

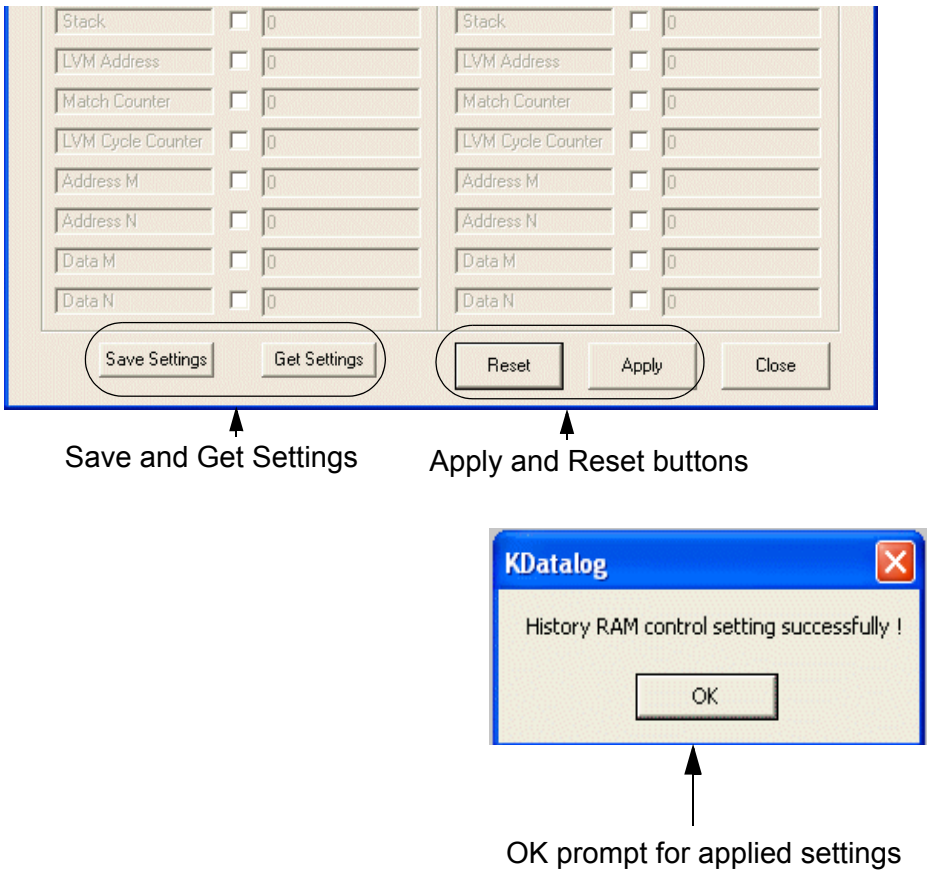
Figure 106. Setting Trigger Conditions



Save Settings - Save the current settings

Get Settings - Restore the previous settings

Figure 107. Apply/Reset Save/Get Settings



NOTE — The user can only apply the history RAM to the currently loaded pattern.

Breaktrap Settings

Breaktrap setting operations are available under the Engineering property page window only. Breaktrap settings are conditions set by the user to configure the Kalos 2 system to specific requirements prior to executing a test flow.

Once the user has selected the desired Kalos 2 slice to Breaktrap on, one of the following available Breaktrap settings can be chosen:

Pause / Step — When the Pause / Step Breaktrap is set, the user can step through each command line in a test.

BreakMeas — When BreakMeas is set on a selected test/measurement, the program executes all tests in the flow up to and including the selected test, then waits for the user to click on the Start or Stop button or launch Kalos 2 application/debugging tools, such as Shmoo, Test Debugger, and ShowBitz.

BreakTestSeq — BreakTestSeq operates the same as BreakMeas, however this setting allows the entire sequence to run.

BreakFail — BreakFail can be used to detect the first failing tests in the test flow. However, after the first failing test is detected, you can manually step through the test flow. After the failing test is displayed in the Action field, users can launch the ShowBitz utility to modify the current settings, that is, voltage levels, timing, etc.

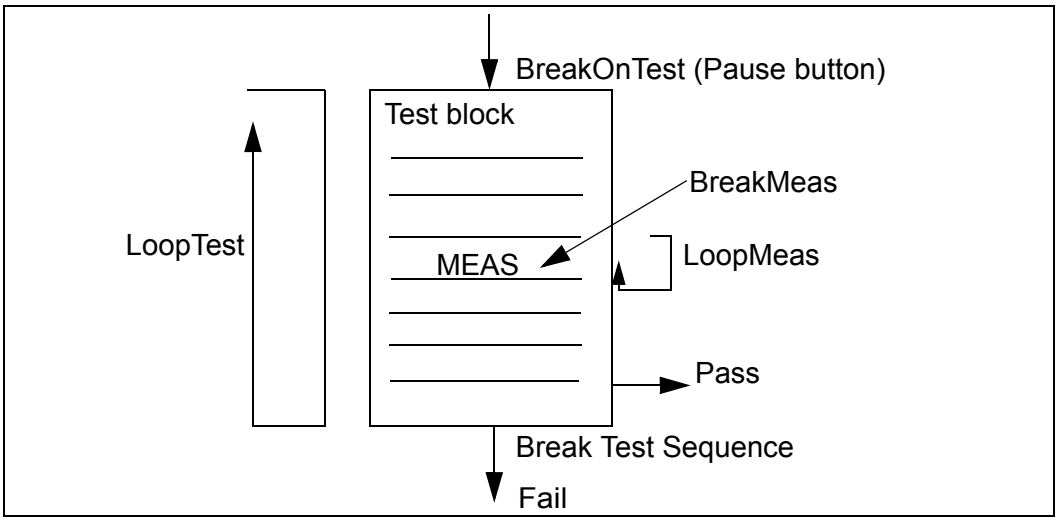
LoopTest — LoopTest Breaktrap is useful when examining signals on the oscilloscope. While looping on a test, the user can launch the Test Debugger application to modify DPS, Levels, and Timings value on-the-fly.

LoopMeas — LoopMeas Breaktrap is useful when examining signals on the oscilloscope. While looping on a measurement, the user can launch the Test Debugger application to modify DPS, Levels, and Timings values on-the-fly.

NOTE — You can only debug one slice at a time. Choose the slice by clicking on the slice you wish to debug under Debug Slice in the Breaktrap Settings area on this property page.

A visual diagram, showing each breaktrap setting, is provided in Figure 108.

Figure 108. Breaktrap Settings



Implementation

Following is the definition of the Breaktrap Settings, as defined by the Kalos 2 Test System.

Test

Test is the execution of each item in its SEQUENCE.

NOTE — Test in the Kalos Test Language is a point in a test flow. It contains a test number, a description of up to 80 characters, and a SEQUENCE. The SEQUENCE can contain names of resources (data which are applied to the tester), actions (taking a measurement, setting a delay, running/stopping the pattern generator, executing a PAUSE, setting a power supply, pin, or pingroup to a state), and the names of C-functions declared in a CMODULE statement.

In Example 1 on page 172, the execution of the IccStandbyHi test implies execution of every item between the open and closed brackets of the SEQUENCE:

```
Levels_VccStandby_hi,
StandbyICChi_VCCPP,
SET(CECONTROL,VIH),
SET(VCC0,MAIN),
SET(VPP1,MAIN),
StandbyHIIcc_VCC0,
MEAS(PMU)
```

In Example 2 on page 173, the execution of the Read_CKBD_all test implies execution of:

VCC_5V_VPP_0V,
Levels_Read,
READ_FF_STATE,
cycle_table1,
read_CKBD,
PG_RUN,
PG_STOP()

Measurement

1. A measurement taken on one of the power supplies or the parametric measurement unit: MEAS (VCC0 I VCC1 I VPP0 I VPP1 I PMU)

   or

2. The execution of a pattern burst: PG_RUN ( ).

In Example 1 on page 172, execution of the Measurement in the IccStandbyHi test is the execution of the MEAS(PMU) command.

In Example 2 on page 173, execution of the Measurement in Read_CKBD_all test is the execution of the PG_RUN() command.

FAIL

FAIL is defined as a fail of a measurement. Note: There could be more than one measurement in a test SEQUENCE.

Step

Step is to sequentially execute every command line (resource statement, action, C-function) in its SEQUENCE upon pressing the Start button. To enable the Step Breaktrap Setting, the Pause button must first be selected.

Examples

The following device test program examples are provided in order to illustrate and step the user through setting up and executing the following:

- BreakMeas Breaktrap Setting
- BreakFail Breaktrap Setting
- LoopTest Breaktrap Setting
- LoopMeas Breaktrap Setting
- Pause Breaktrap Setting

Test Flow

The following test flow is used in this Examples section.

```
    FLOW  flow4 = {


    //test_name,          pass_branch,                fail_branch;

    Opens,                Shorts,                     Bin2;
    Shorts,               InputLeakageHigh,           Bin3;
    InputLeakageHigh,     InputLeakageLow,            Bin4;
    InputLeakageLow,      OutputLeakageHigh,          Bin5;
    OutputLeakageHigh,    OutputLeakageLow            Bin6;
    OutputLeakageLow,     IccStandbyHi,               Bin7;
    IccStandbyHi,         VCCReadICC_CMOS,            Bin8;
    VCCReadICC_CMOS,      VCCReadICC_TTL,             Bin9;
    VCCReadICC_TTL,       Read_dut_ID,                Bin10;
    Read_dut_ID,          Erase_array,                Bin11;
    Erase_array,          Read_all_ff,                Bin12;
    Read_all_ff,          Write_5555_WORD,            Bin13;
    Write_5555_WORD,      Read_5555_WORD,             Bin14;
    Read_5555_WORD,       erase_block0,               Bin15;
    erase_block0,         readff_block0,              Bin16;
    readff_block0,        Write_AAAA_all,             Bin17;
    Write_AAAA_all,       Read_AAAA_all,              Bin18;
    Read_AAAA_all,        Write_5555_all,             Bin19;
    Write_5555_all,       Read_0000_all,              Bin18;
    Read_0000_all,        Erase_array1,               Bin20;
    Erase_array1,         Read_all_ff1,               Bin21;
    Read_all_ff1,         Write_CKBD_all,             Bin22;
    Write_CKBD_all,       Read_CKBD_all,              Bin23;
    Read_CKBD_all,        Write_INVCKBD_all,          Bin24;
    Write_INVCKBD_all,    Read_0000_all1,             Bin25;
    Read_0000_all1,       Bin1,                       Bin26;
};
```

Example 1

The following section of code illustrates an example of a parametric test. The name of the test is IccStandbyHI.

```
TEST IccStandbyHi = {
TESTNO = 800;
   DESC = "This test is for VCC Standby Hi Current";

SEQUENCE =   {
```

```
 Levels_VccStandby_hi,          //LEVELS statement
 StandbyICChi_VCCVPP,           //DPSSET statement
 SET(CECONTROL,VIH),            //set CECONTROL to VIL
 SET(VCC0, MAIN),               //using levels in LEVELS
 SET(VPP1, MAIN),
 StandbyHIIcc_VCC0,             //PMUTEST statement
 MEAS(PMU)                      //performs current meas on
                                //VCC0 using the PMU
  };

};
```

Example 2

The following section of code illustrates an example of a functional test. The name of the test is Read_CKBD_all.

```
TEST Read_CKBD_all = {
   TESTNO = 2000;
   DESC = "Read CKBD ";

  SEQUENCE = {
     VCC_5V_VPP_0V,              //DPSSET statement
     Levels_Read,                //LEVELS statement
     READ_FF_STATE,              //SEQUENCE statement
     cycle_table1,
read_CKBD,                       //PATTERN statement
     PG_RUN
  };

 };
```

Set Up and Execute BreakMeas Breaktrap Setting

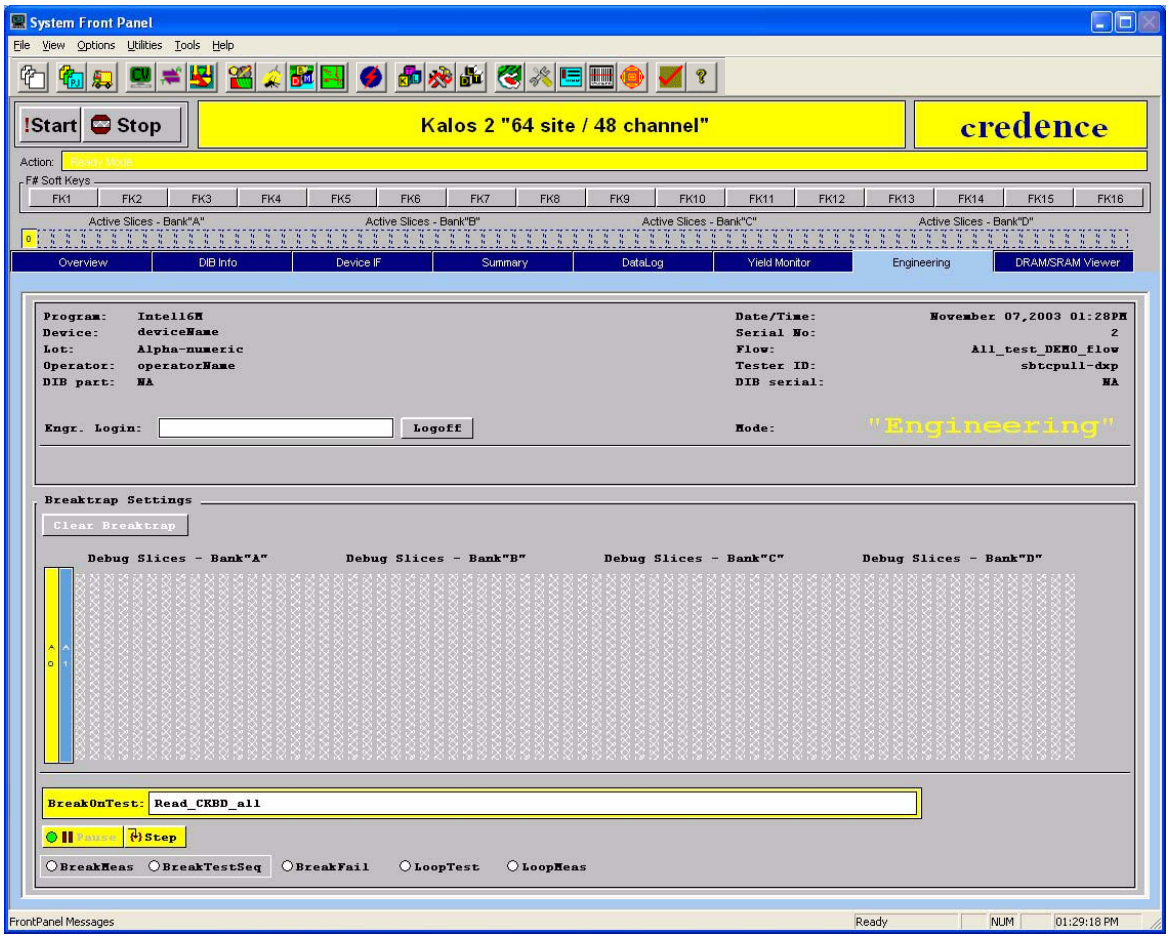
Once BreakMeas is set on a selected test/measurement, the program executes all tests in the flow up to and including the selected test, then waits for the user to click on the Start or Stop button or launch Kalos 2 application/debugging tools, such as Shmoo, Test Debugger, and ShowBitz.

If the user executes a shmoo plot, every data point on the plot is the result of running the selected breaktrap/measurement. The Test Debugger tool reads the current test components and allows viewing and modification of them. ShowBitz displays and allows modification of the contents of all hardware registers in the Kalos 2 system.

1. Load the desired test program. Select the appropriate flow from the **Flow** pulldown menu (the Flow field is in the header section of the Front Panel Overview Property window).

2. Place the cursor on the check box (circle) to the left of BreakMeas and click the left mouse button. When BreakMeas is enabled, the check box (circle) button is colored green.
3. In the Breaktrap Settings section, under **Debug Slice**, select the Kalos 2 slice you wish to Breaktrap on.
4. Place the cursor on the field next to **BreakOnTest**: This activates a pulldown menu displaying all available tests that are loaded in the program. In the example shown in Figure 109, test `Read_CKBD_all` is selected.

Figure 109. BreakMeas - Select Read_CKBD_all Test



5. Click on the Start button to execute the test program. All tests in the flow are executed up to and including the Read_CKBD_all test. At this point, the Action field at the top section of Front Panel turns yellow and displays the name and test number (2000) of the Read_CKBD_all test: On Measure: Read_CKBD_all id=2000.

6. A display of the contents can be viewed from the CView utility window.
7. Once BreakMeas is set on a test, the user can launch Kalos 2 application tools, such as Shmoo, Test Debugger, and ShowBitz.
8. If the user clicks the Start button again, the tester continues executing subsequent tests in the flow until it finds the next measurement and then will BreakMeas on that. In this example, the next measurement is the pattern write_INCKBD.

The user may also set BreakMeas on any other measurement in the flow by selecting it from the BreakOnTest field and clicking on the Start button. This measurement must follow the Read_CKBD_test, otherwise the test program executes through the end of the flow.

If the user clicks on the Clear Breaktrap button while BreakMeas is set on a test, the ENDTEST of the EVENTMAP is executed (if one exists), then the pattern generator is reset and the message `mode set to NORMAL` appears in the CView window.

Set Up and Execute BreakFail Breaktrap Setting

The BreakFail Breaktrap Setting can be used to detect all failing tests in the test flow.

1. Load the desired test program and select a flow. For this example the flow loaded is as follows:

```
FLOW   failing flow = {

          //test_name,    pass_branch,              fail_branch;

    Opens,                Shorts,                   Bin2;
    Shorts,               InputLeakageHigh,         Bin3;
    InputLeakageHigh,     InputLeakageLow,          Bin4;
    InputLeakageLow,      OutputLeakageHigh,        Bin5;
    OutputLeakageHigh,    OutputLeakageLow          Bin6;
    OutputLeakageLow,     IccStandbyHi,             Bin7;
    IccStandbyHi,         VCCReadICC_CMOS,          Bin8;
    VCCReadICC_CMOS,      VCCReadICC_TTL,           Bin9;
    VCCReadICC_TTL,       Read_dut_ID,              Bin10;
    Read_dut_ID,          Erase_array,              Bin11;
    Erase_array,          Read_all_ff,              Bin12;
    Read_all_ff,          Write_5555_WORD,          Bin13;
    Write_5555_WORD,      Read_5555_WORD,           Bin14;
    Read_5555_WORD,       erase_block0,             Bin15;
    erase_block0,         readff_block0,            Bin16;
    readff_block0,        Write_AAAA_all,           Bin17;
    Write_AAAA_all,       Read_AAAA_all,            Bin18;
    Read_AAAA_all,        Write_5555_all,           Bin19;
```

```
    Write_5555_all,         Read_0000_all,              Bin18;
    Read_0000_all,          Erase_array1,               Bin20;
    Erase_array1,           Read_all_ff1,               Bin21;
    Read_all_ff1,           Write_CKBD_all,             Bin22;
    Write_CKBD_all,         Read_0000_all1,             Bin23;
    Read_0000_all1,         Write_CKBD_all,             Bin24;
    Write_INVCKBD_all,      Read_0000_all2,             Bin25;
    Read_0000_all2,         Bin1,                       Bin26;
};
```

NOTE — Write_CKBD_all programs the entire array to a checkerboard pattern. Therefore, Read_0000_all1, the subsequent test in the flow, fails.

2. Select BreakFail.
3. Select the Debug Slice.

NOTE — After the failing test is displayed in the Action field, the user can launch the ShowBitz utility to modify the current settings (e.g., voltage levels, pattern uRam contents). To re-execute the test, select PG Burst in the Navigator tree of ShowBitz. Click once on the Run button to execute the failing test. To see if any pins failed, click on the *TG PassFail View* under Omni view to display all the channels. In order to bin-out the device, return to Front Panel and click on the Start button. A PASS or FAIL flag displays.

4. Click on the Start button to execute the program. The program breaks on the first fail, which in this case is Read_0000_all1 test.
5. If the user clicks the Start button again (if there are no other failing measurements), program execution stops.

Set Up and Execute LoopTest Breaktrap Setting

The LoopTest Breaktrap is useful when examining signals on the oscilloscope. While looping on a test, the user can launch the Test Debugger application to modify DPS, Levels, and Timings value on-the-fly. (The Apply/Set button in Test Debugger allow modified settings to be re-loaded to the ETX slice and to Kalos 2 hardware.)

1. Load the desired program and select a flow.
2. Select the LoopTest Breaktrap Setting.
3. Select the Debug Slice.
4. From the BreakOnTest pulldown menu (see Figure 109), select the Read_CKBD_all test.
5. Click on the Start button to execute the program. All tests in the flow are executed up to the Read_CKBD_test. Once this test is reached, the program loops on the entire test sequence, i.e., timing, levels, power supply setup,

loading of the pattern, and pattern execution. The Action field at the top of Front Panel turns yellow and displays the message: Looping on Test: Read_CKBD_all id=2000.

6. A display of the test contents can be viewed from the CView utility window.

NOTE — The user can click on the PAUSE button to pause looping. The program pauses at the beginning of the read_CKBD_all test. As the step button is clicked, each line in the read_CKBD_all test executes sequentially. After the read_CKBD pattern is loaded, the user can launch ShowBitz, modify the current hardware configuration, and execute (or loop on) the pattern using the PG Burst window (refer to steps 7 and 8 in the Set Up and Execute Pause Breaktrap Setting section of this chapter).

7. If the user clicks the Start button again, the program begins to loop on the next test in the test flow. In this example the next test is write_INVCKBD_all.
8. The user can stop looping either by clicking on the Clear Breaktrap or the Stop button. In both cases the pattern generator stops. The difference is the BreakOnTest field shows the Null_Test if Clear Breaktrap is clicked, whereas if the Stop button is clicked, it shows the test originally set as the Breaktrap test (read_CKBD_all.

Set Up and Execute LoopMeas Breaktrap Setting

The LoopMeas Breaktrap is useful when examining signals on the oscilloscope. While looping on a measurement, the user can launch the Test Debugger application to modify DPS, Levels, and Timings values on-the-fly. (The Apply/Set button in Test Debugger allow modified settings to be re-loaded to the ETX slice and to Kalos 2 hardware.)

1. Load the desired test program and select a flow.
2. Select the LoopMeas Breaktrap Setting.
3. Select a Debug Slice.
4. Select the Read_CKBD_all test from the BreakOnTest pulldown menu. Click on the Start button to execute the test program. All tests in the flow are executed up to the Read_CKBD_all test. The program then loops on the pattern Read_CKBD_all. The message: Looping on Measurement: Read_CKBD_all id=2000 is displayed in the Action field of Front Panel.

A display of the test contents when LoopMeas is set on the Read_CKBD_all test can be viewed from the CView utility window.

5. Click the Start button again to begin looping on the next measurement in the test flow.

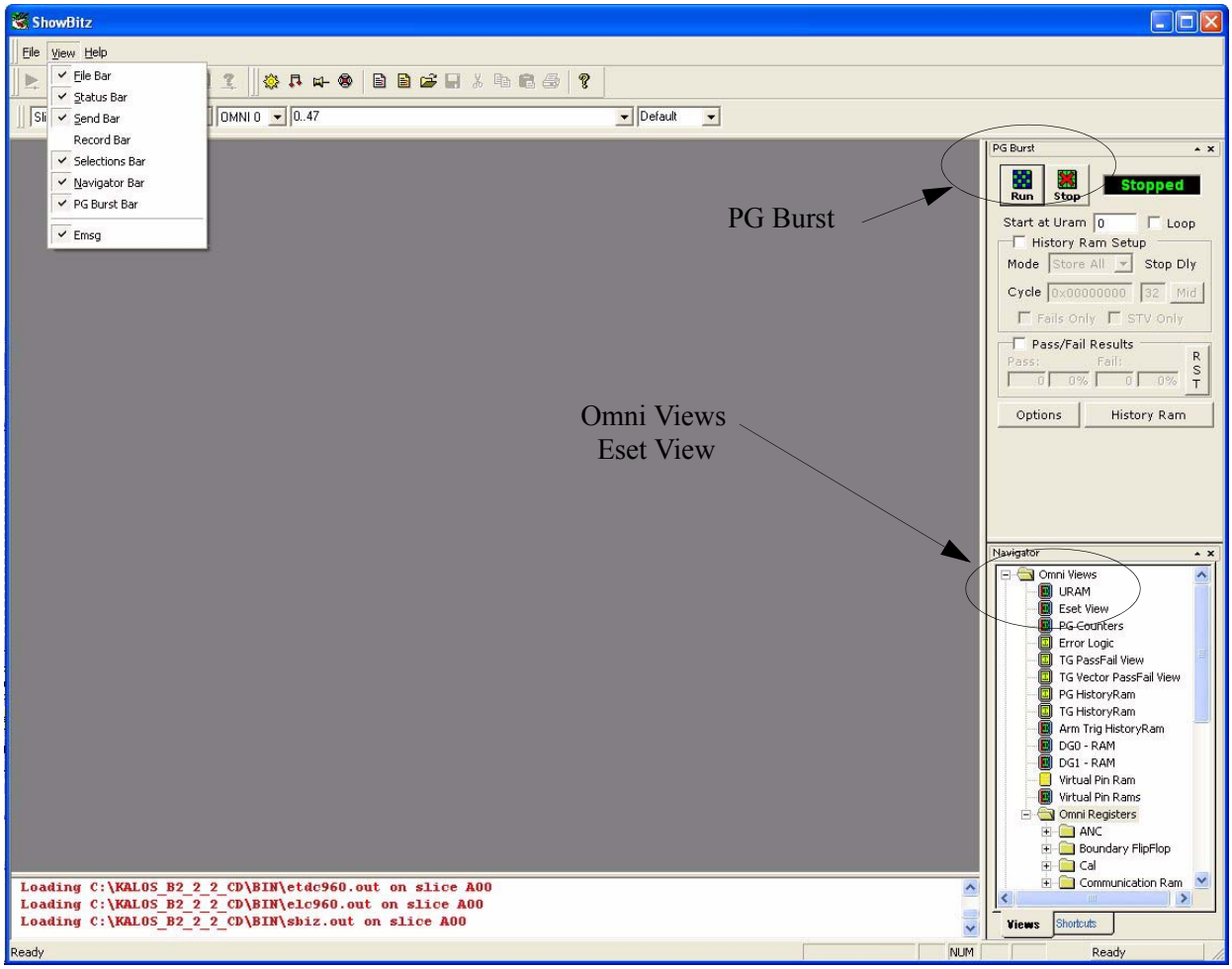
6. The user can stop looping by clicking the Clear Breaktrap or Stop button. In both cases the pattern generator stops. The difference is the BreakOnTest field shows the Null_Test if Clear Breaktrap is clicked, whereas if the Stop button is clicked, it shows the test originally set as the Breaktrap test (read_CKBD_all).

Set Up and Execute Pause Breaktrap Setting

When the Pause/Step Breaktrap is set, the user can step through each command line in a test. Users can step to the point of loading a pattern, then launch the ShowBitz utility to modify timings, levels, PMU, DPS values, and pattern uRam contents on-the-fly.

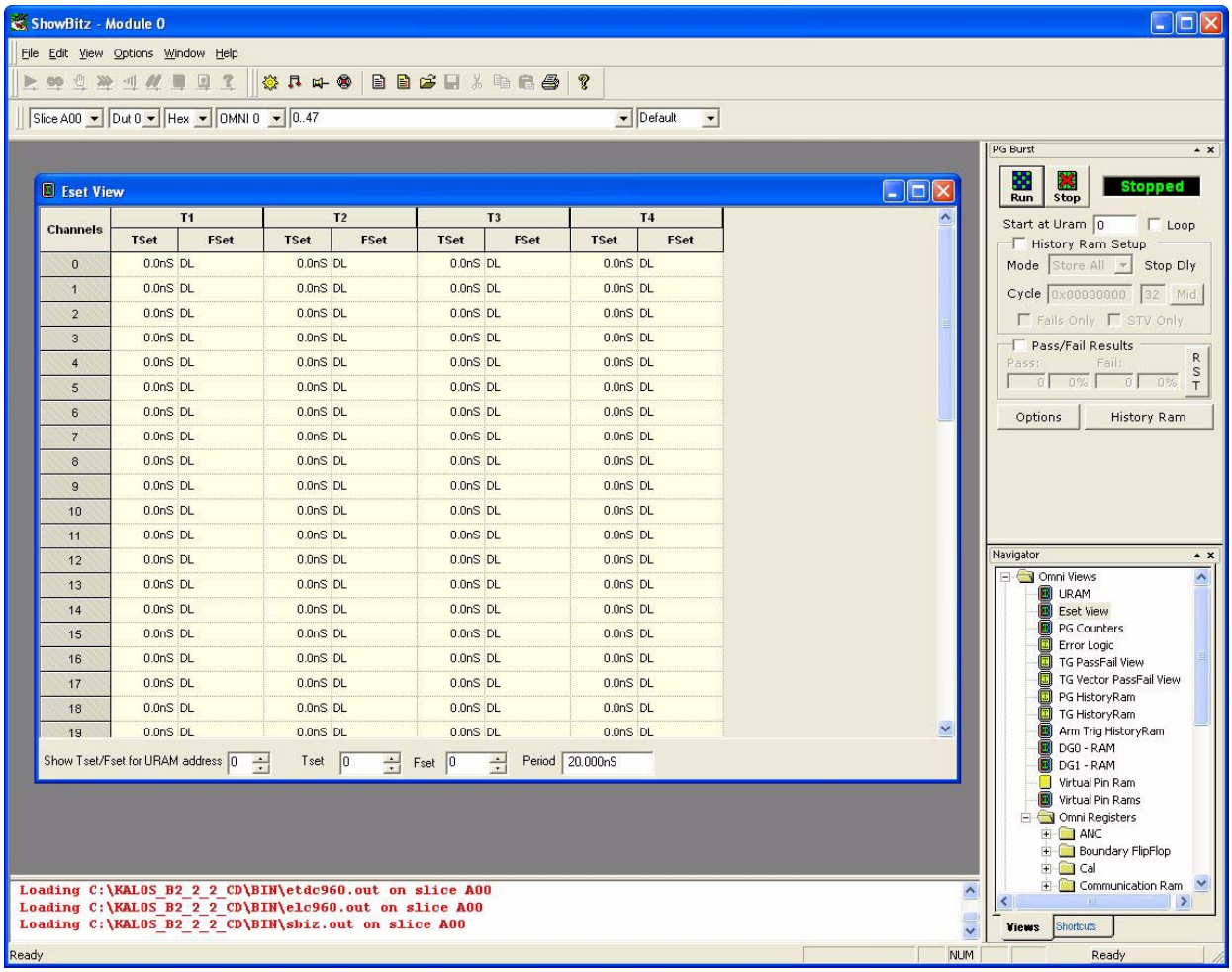
1. Load the desired test program.
2. Select the Pause button. The Step button automatically becomes highlighted.
3. Select a Debug Slice.
4. Choose the Read_CKBD_all test.
5. Click on the Start button to execute the test program. The program runs until it reaches the Read_CKBD_all test. It then pauses and waits for the user to click on the Step button. Each command line inside the Read_CKBD_all test is executed sequentially as the user clicks on the Step button.
6. Click on the Step button until the Read_CKBD_all pattern is loaded. As the Step button is pressed, a display of the test contents can be viewed from the CView utility window.
7. Launch the ShowBitz utility by selecting Utilities--> SHOW BITZ from the Front Panel menu bar. Select the slice you are breaktrapped on (slice A0 or slice A1). In the PG Burst window (see Figure 110) click on the Run button for the Read_CKBD_all pattern to execute Click on the box next to loop and press the Run button: the program loops on the Read_CKBD_all pattern. Click on the Stop button in the PG Burst window to discontinue looping.

Figure 110. Pause_Step - ShowBitz PG Burst



8. In ShowBitz, click on Omni Views -> Eset view and then on Level Sets. This launches Eset View (channels) windows (see Figure 111). These windows display the timing and level sets applied to all channels/pingroups specified in the channel slices when the Read_CKBD_all pattern is loaded. Now only the Timing and Levels settings applied to ADDRESS DBUS and CECONTROL pingroups are displayed. The user can now modify the levels, format, and timing and click on the Run button of the PG Burst window to run the Read_CKBD_all pattern with the modified settings.

Figure 111. Pause_Step - ShowBitz Eset View



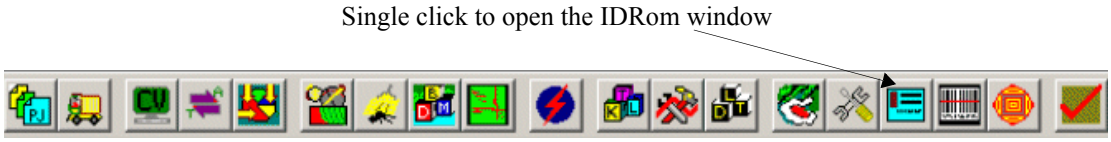
Idrom Property Page

Each Kalos board contains five serial electrically erasable non-volatile memories (Motherboard, PMU, DPS, EMV modules, and ETX). Each is called an IDROM. IDROM is an NVM memory chip which stores module information on each Kalos board module. This information includes part number, revision number, ECO level, etc.

In addition, each backplane in the test head contains an IDROM. Each IDROM contains formatted data identifying the manufacturer of the hardware and its capabilities. This information is programmed into the IDROM during the manufacture of the hardware. Each time the Kalos 2 test system is initialized, the IDROM data is retrieved and made available to all Kalos 2 boards and XP software. This information is used by Kalos 2 software to determine how to best utilize the hardware.

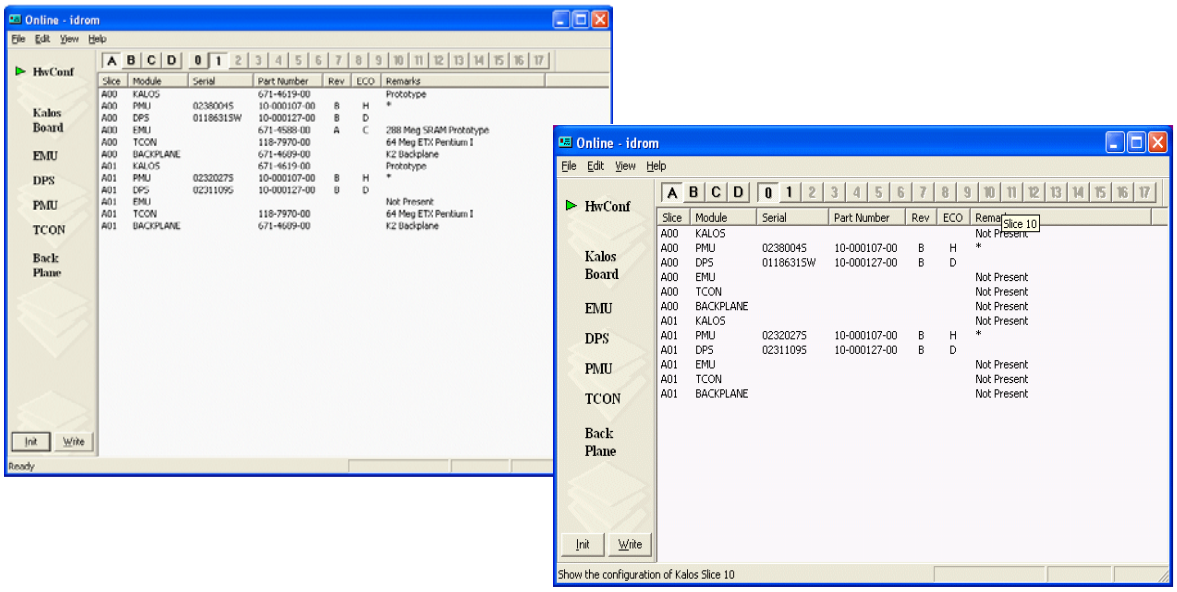
The Idrom utility is launched by clicking on the IDRom icon on Front Panel, as shown in Figure 112, or it can be selected from the Utilities pulldown menu item. The IDROM utility appears, as shown in Figure 113.

Figure 112. IDRom Icon



The Idrom tool allows users to view this detailed information as well as check serial numbers and other information used to identify the slices mounted on the Kalos 2 boards.

Figure 113. Idrom Window

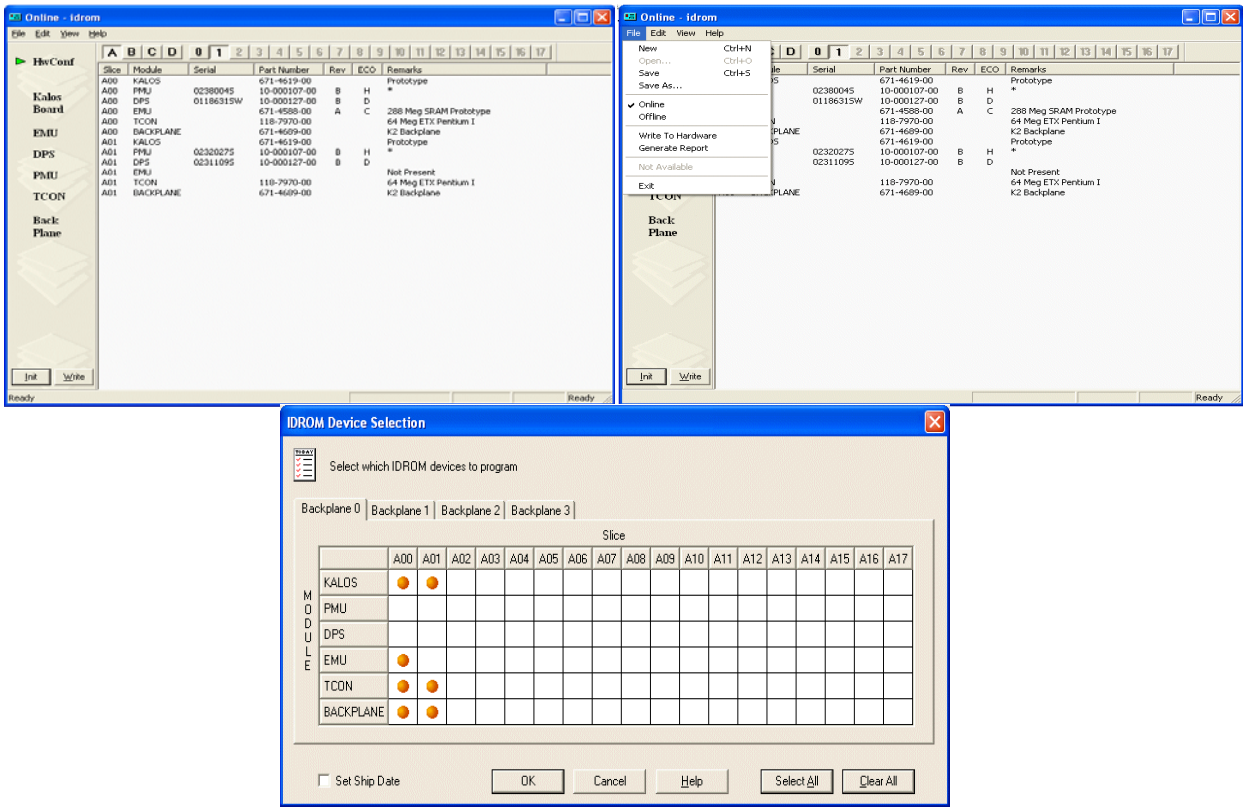


Save To IDROM

IDROM information can be copied, or saved on the hard drive or to a portable drive. The procedure follows (see Figure 114):

1. Launch the Idrom utility.
2. Click on Kalos to read the Kalos board xxxxxxxS from *Lot Number*.
3. Save all IDROM data by selecting *File,* from the menu bar option, then select *Generate Report*.
4. Select all slots to be saved.
5. Click *Save to File*; save the file in .txt format.
6. Open the .txt file in Notepad or Wordpad.

Figure 114. Save to IDROM Procedure



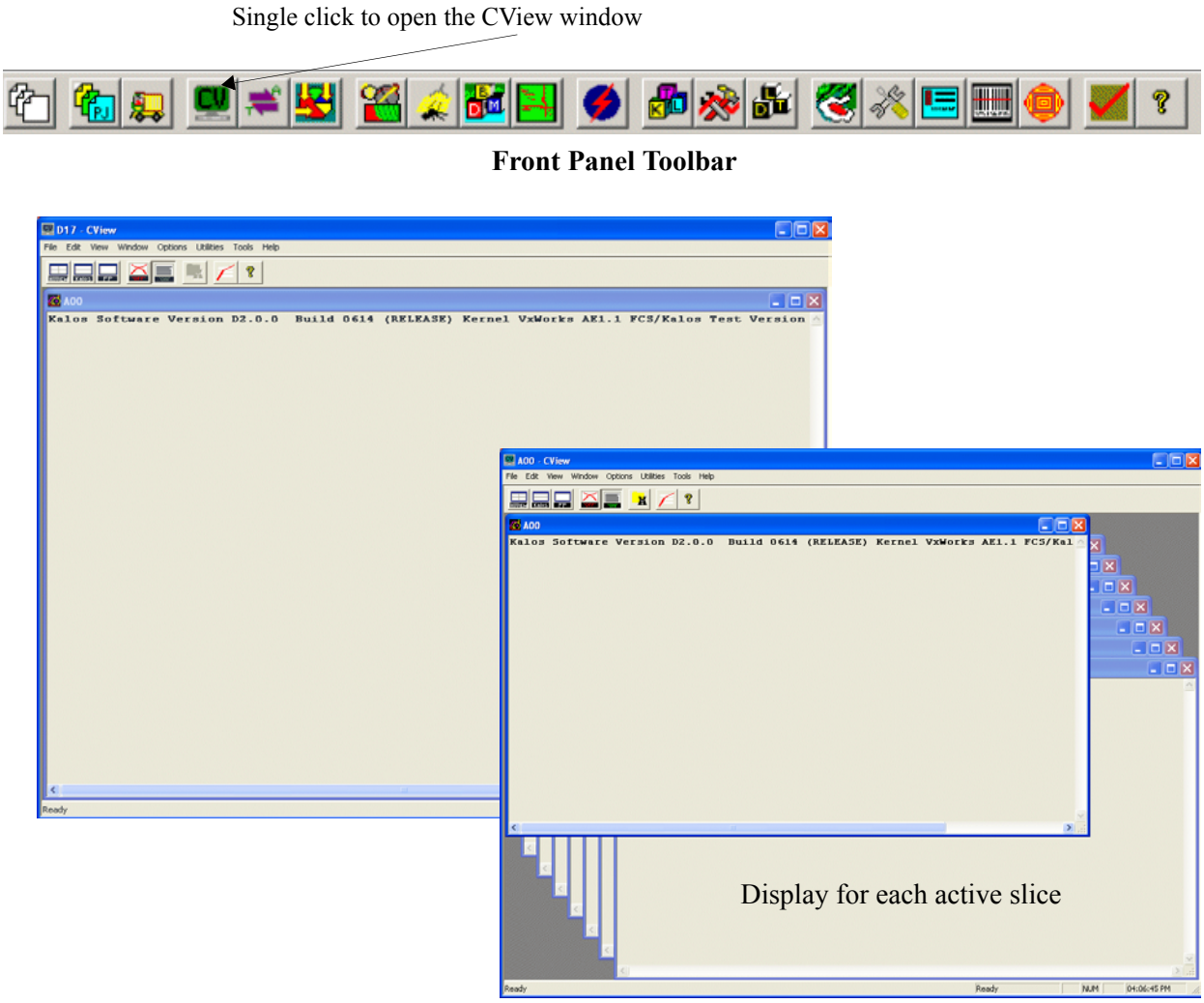
CView Utility

The CView (Console Viewer) utility (see Figure 115), is a debug viewer for observing communication messages between the CPU of each Kalos 2 board and workstation computer. These communication messages show the processing of events and sequence of execution by the Test Program Executor (TPE). A display panel appears for each active slices.

CView Window

The CView window opens a console display of all execution activity. It is suggested that the user open the CView window at the start of each session and position the window out of the center of the CRT display, where it can be seen, but not as the main window. Open the CView by double clicking on the CV icon in the Front Panel window or by selecting *Utility => CVIEWER* from the menu bar.

Figure 115. CView (Console Viewer)



The CView utility does give some run time overhead or causes additional run time in production. Do not open the CView utility in the middle of a production run since it might crash the system due to an initiate CPU for communications.

NOTE — The SHMOO in the KTL will be shown in the CView window.

Calibration and Diagnostics

This section describes basic calibration and diagnostics functions.

Kalos 2 diagnostics and calibration programs are located in the C:\Kalos\bin directory. The standard calibration program is called **kcal.cal**, and the standard diagnostics program is called **kchk.dia**. There may be other programs visible in the menu, however, they are not standard maintenance programs and should not be run without full understanding of the calibration software.

The Kalos 2 tester is automatically calibrated by running calibration/diagnostics from Front Panel. Calibration, beyond power supplies, is performed by the software, which requires no manual manipulation. In order to execute calibration, however, manual intervention is required to mount two types of load boards at various points in the process.

Calibration Compatibility

Regardless to what Kalos OS system is running, the latest software version of calibration and diagnostics must be used. Enhancements and improvements to the calibration and diagnostics software help to ensure that the most accurate and robust system environment is available. Calibration of the system is intended to always be backward compatible to previous operation system revisions.

dibcal.cal

The dibcal.cal program is invoked by selecting C:\Kalos\bin\dibcal.cal from the File => Open menu or from the Open Flow tool bar button in the Calibration/Diagnostics window (see Figure 118). The dibcal.cal calibrates to the open socket of the load board. This calibration program must be run anytime the Kalos 2 tester is initialized (that is, other calibration programs were run, loss of communications, Map INIT, load board/probe card change, Front Panel load, etc.). This calibration adjusts tester timing for the specific device load board and thus requires that the board is present.

NOTE — This program is the same as DIB-CAL on Front Panel. Refer to the *DIB Info* tab selection.

kcal.cal

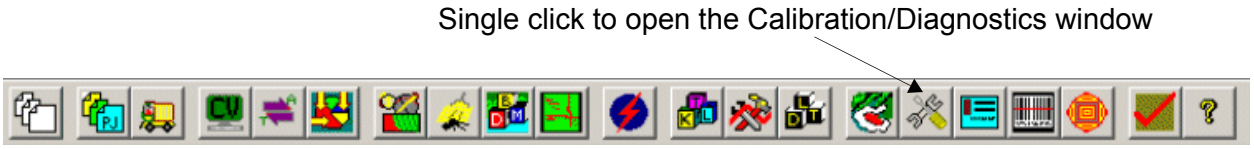
The standard calibration program is kcal.cal. It is located in the same directory as dibcal.cal. The program appears as a window within the Calibration/Diagnostics window. Both calibration and diagnostics programs are controlled in the same matter. The kcal.cal calibrates out to the pogo pin. Calibration is run as a periodic

maintenance; whenever a board is changed; a power system change occurs; and with any major change, such as repair of the tester. **Periodic maintenance calibration is run every 90 days**.

Running System Diagnostics

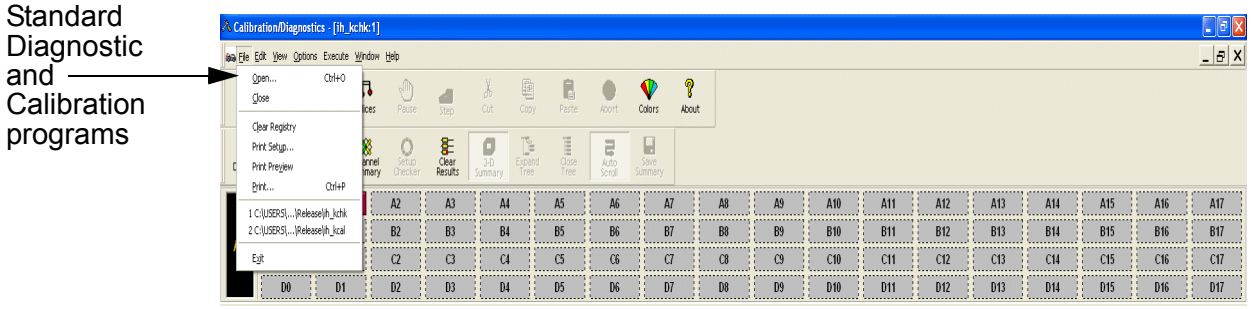
System diagnostics is launched by clicking on the Cal/Diag icon on the Front Panel toolbar (see Figure 116), or by selecting CAL DIAG from the Utilities pulldown menu.

Figure 116. Front Panel Toolbar



Calibration and diagnostics software programs are located under the File menu, inside the Calibration/Diagnostics window (see Figure 117).

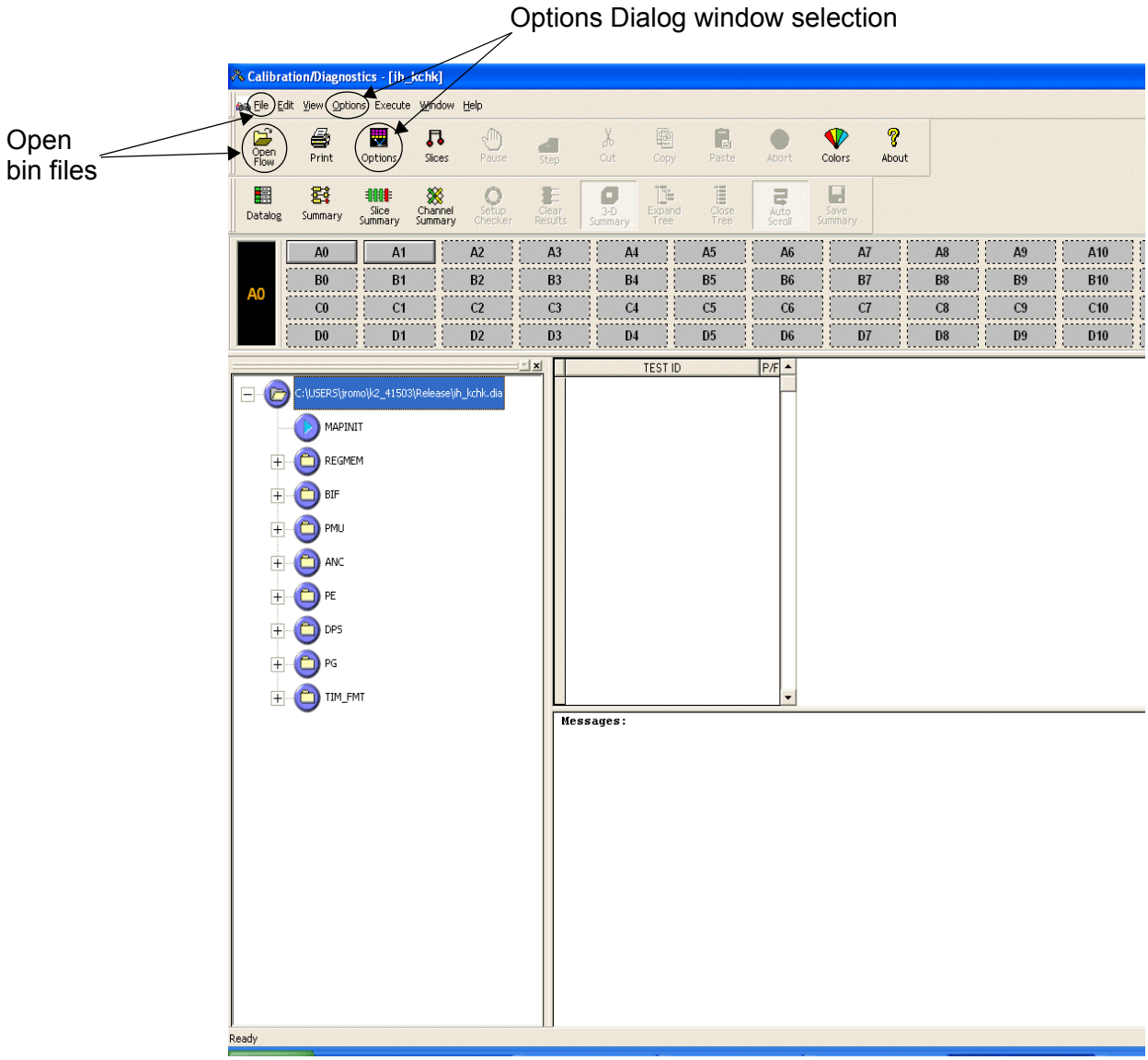
Figure 117. Calibration and Diagnostic Programs



Diagnostic Program - kchk.dia

The kchk.dia program is used to verify the system hardware. Invoke this diagnostic program by selectingC:\Kalos\bin\kchk.dia from the File menu in the Calibration/ Diagnostics window. The program appears, as shown in Figure 118.

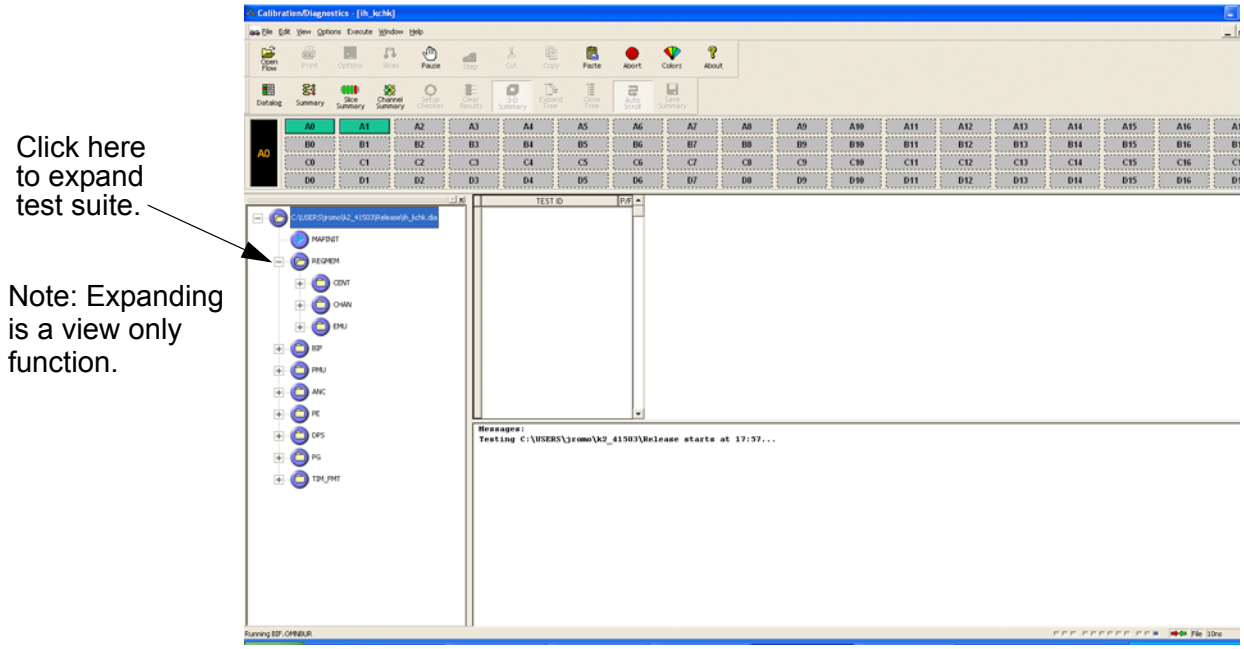
Figure 118. Calibration/Diagnostics Programs



Various test suites are listed on the left side of the window, as shown in Figure 119. Each suite contains several tests that can be viewed by clicking on the “+” box to the left of each test suite’s folder button.

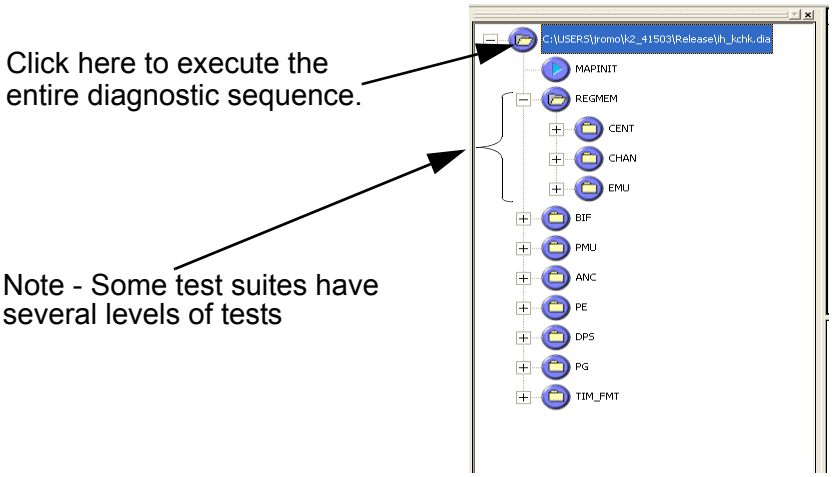
NOTE — Warm up the tester before running diagnostics. Failure to do so can cause test results that are too close to the edge of pass/fail ranges.

Figure 119. Test Suites



To execute a test or test suite, click on the *folder* icon. To execute the entire diagnostic sequence, click on the folder icon next to the program name (see Figure 120).

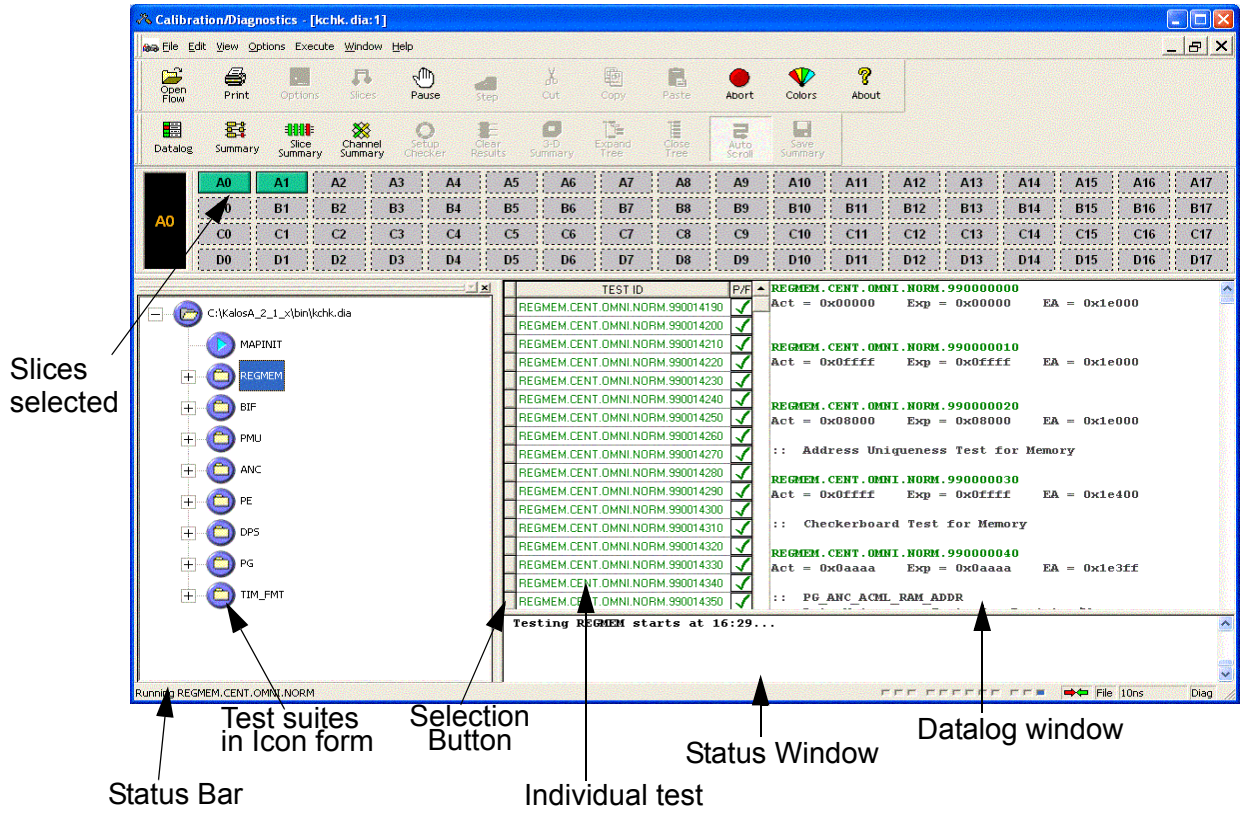
Figure 120. Test Suite Execution



Diagnostic Windows

The Diagnostic program is divided into four windows, as shown in Figure 121. The test suites, in icon form, are displayed in the window on the left. Individual test names (as they are executed) along with pass/fail checkboxes are displayed in the center. The datalog window, which displays test results for each individual test, is on the right. The execution status of the program is displayed in the bottom window.

Figure 121. Diagnostic Windows



To view datalog results, pause the diagnostic test, then click on the selection button to the left of the individual test name in the center window. The test results appear at the top of the datalog window.

The pass/fail (P/F) checkbox displays a *green check mark* for passing tests or a *red x* for failing tests.

Diagnostic Settings

The ability to set and control test parameters, datalogging and hardware selection is accomplished through the Options Dialog (settings) window. This diagnostic setting option is invoked by selecting the Options menu item or the Options icon on the toolbar in the Calibration/Diagnostic window, shown in Figure 118.

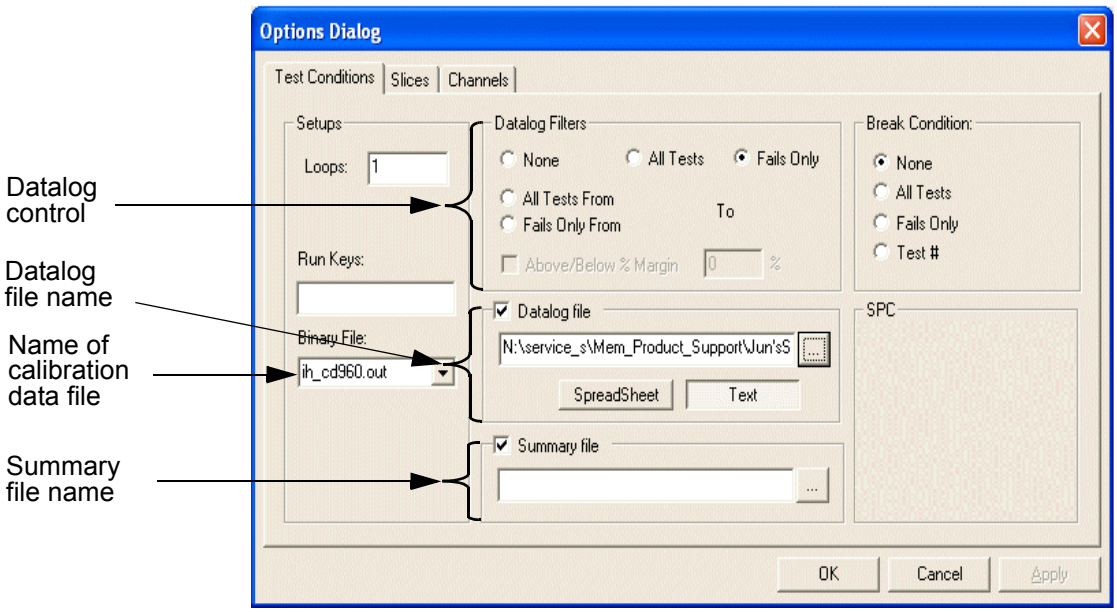
The Options Dialog window, shown in Figure 122, has three pages. As illustrated, the first page is used to establish test parameters and data logging.

The test flow is controlled by way of the *Break Condition* selections which specify where testing stops:

None	no stopping
All Test	stop on all test
Fails Only	stop on fails only
Test #	stop on selected test number (When selected, a window is provided to specify test number.)

SPC (Statistics Process Control) is used for tester development only.

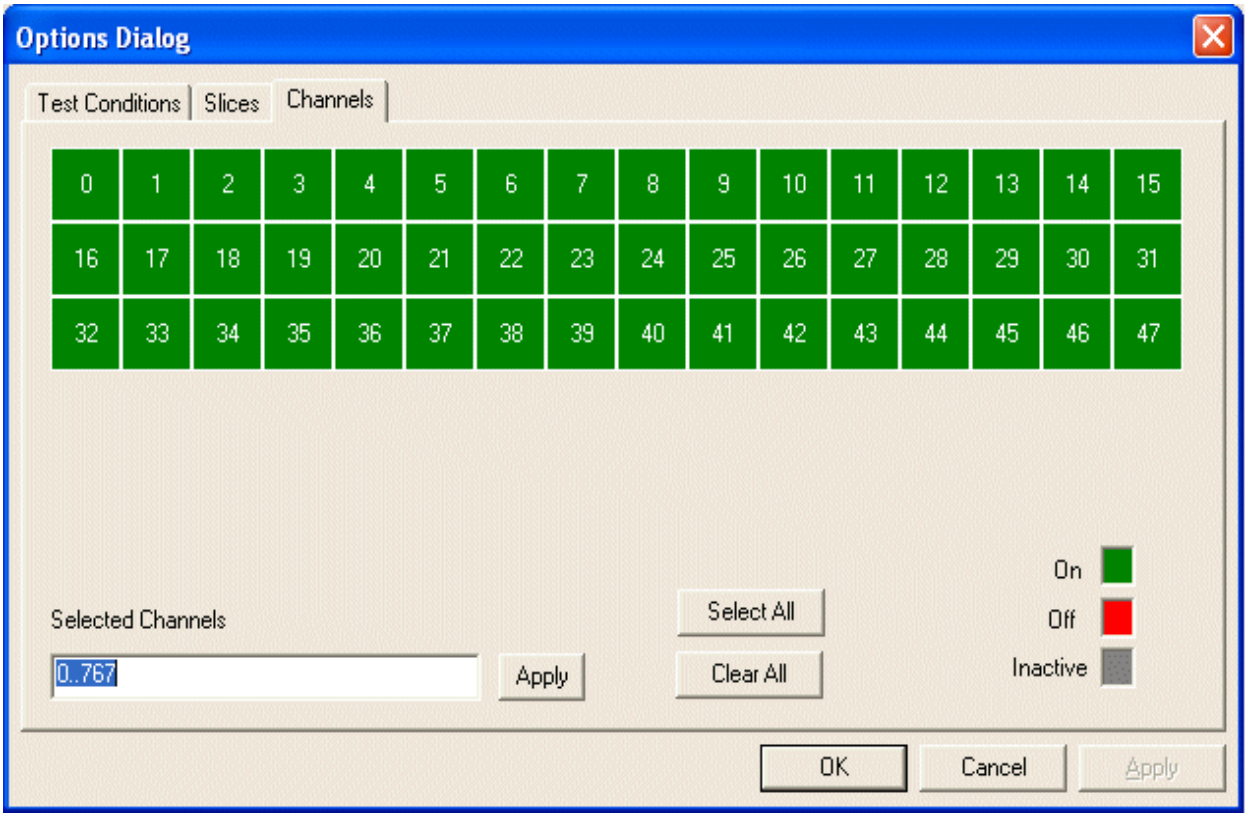
Figure 122. Options Dialog (Settings) Window



NOTE — The calibration data file name and tester speed are standard Credence defaults and should not be altered.

Pages two (see Figure 123) and three of the Options Dialog window are used to select individual slices or channels, respectively, to be tested.

Figure 123. Options Dialog - Page 2



To test a single channel, first click the *Clear All* button, then select the channel to be tested.

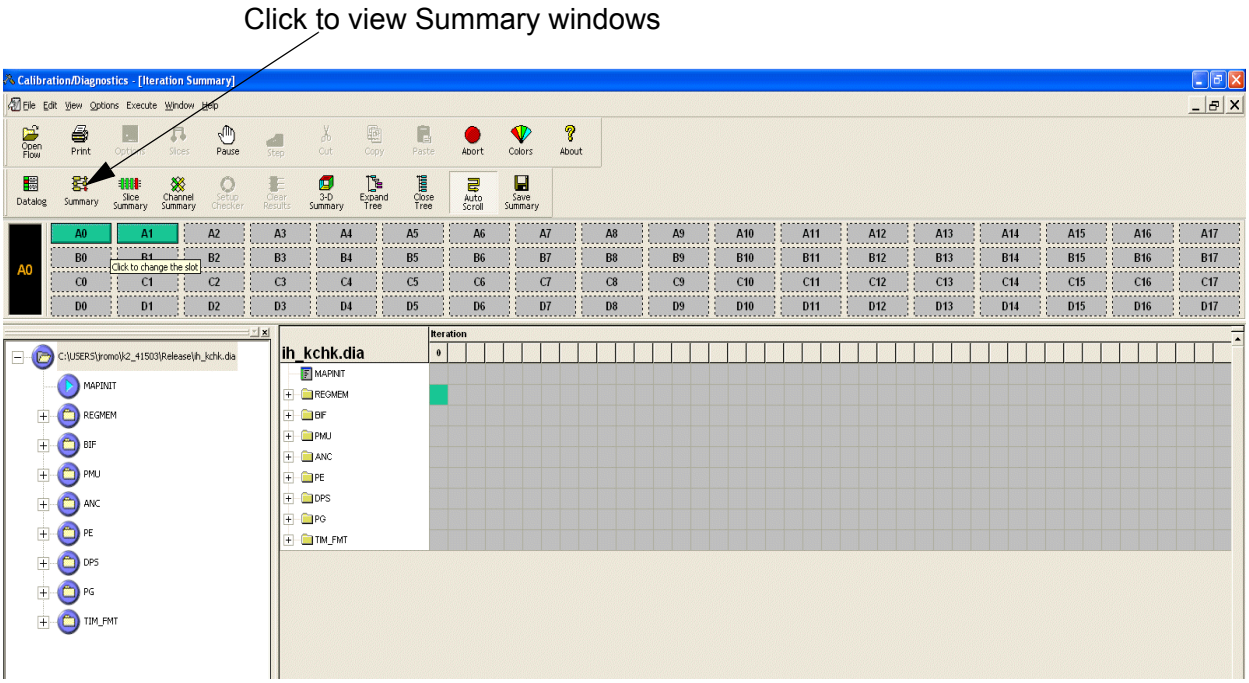
NOTE — Always check the settings pop-up window when opening the diagnostic or calibration programs to ensure proper results.

Summary Window

Graphical summaries with viewing options, as shown in Figure 124, are available in the *[Channel Summary]* options windows. To view the graphical summaries, select the View menu option or click on the Summary icon in the Calibration/Diagnostics window, shown in Figure 124.

The Summary window appears in compressed form, displaying active slices in green.

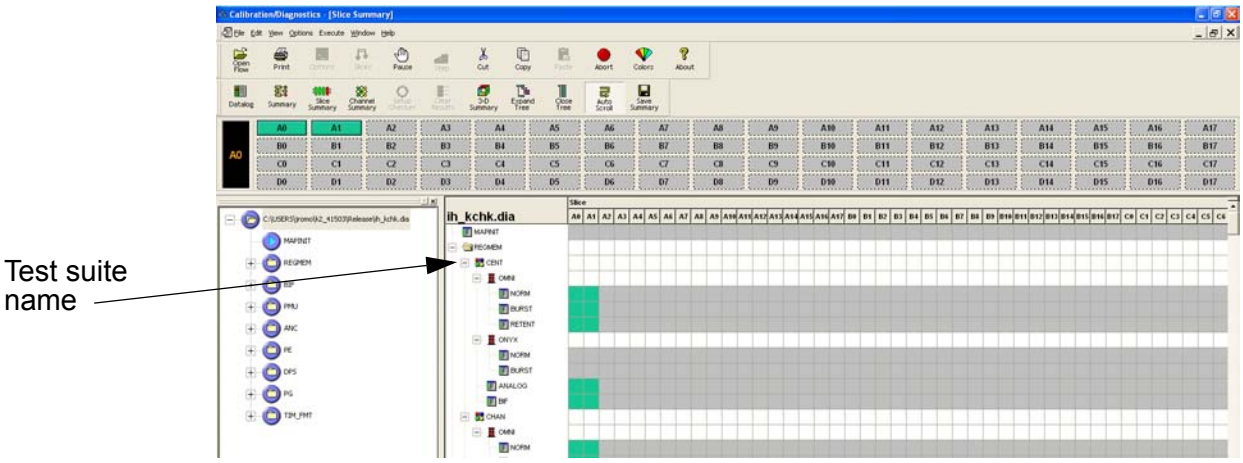
Figure 124. Summary Options



Expanded Summary Window

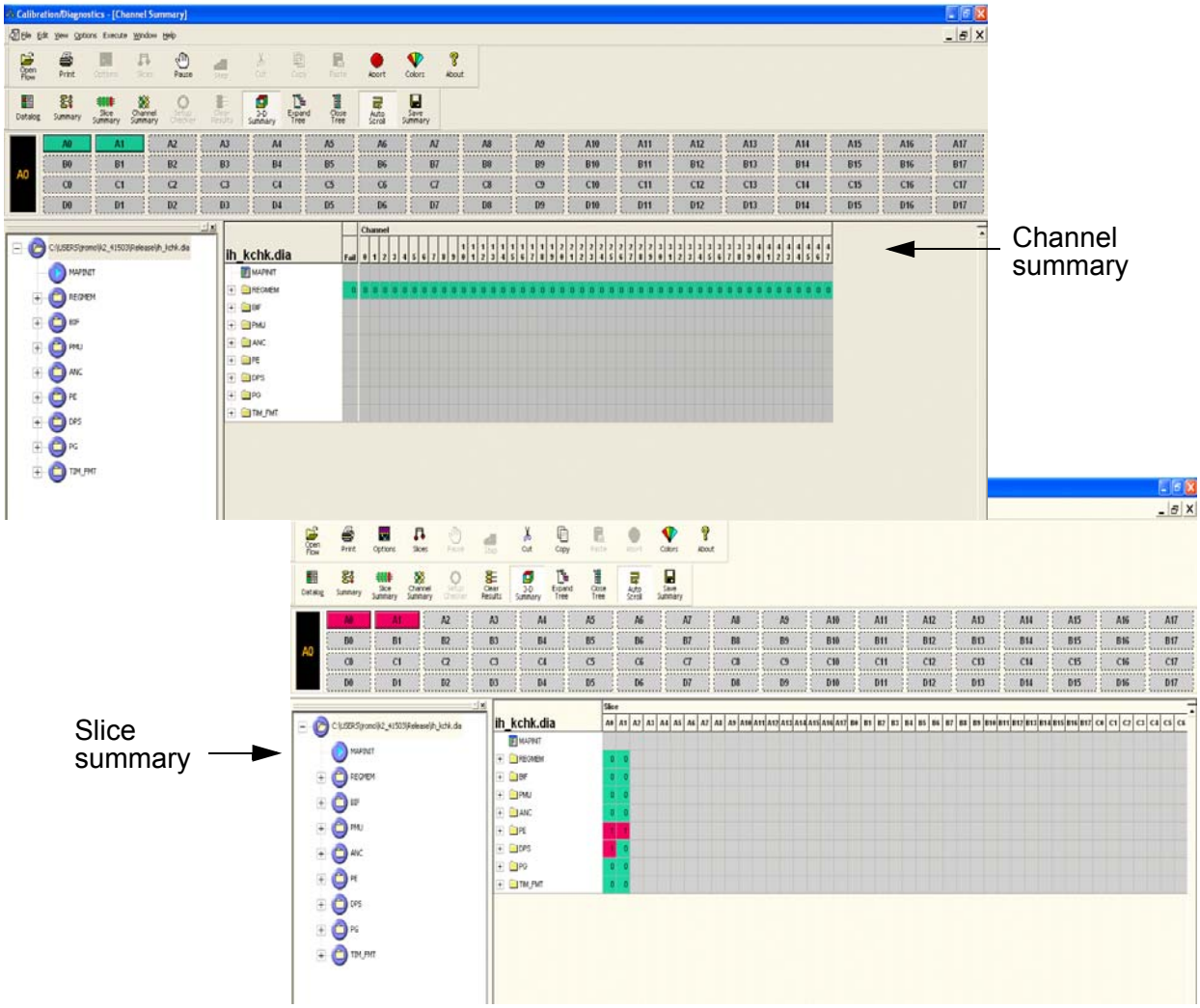
A matrix chart is displayed in the expanded summary window (see Figure 125). The horizontal axis represents the execution number, that is, how many times the program was executed, and the vertical axis depicts the individual test suites. Each matrix square is color coded to depict its test status. A green box indicates the test has completed execution and passed. A gray box represents a test in the sequence that has not been executed. A red box indicates a completed test that failed.

Figure 125. Matrix Chart



Slice and channel summaries are displayed in Figure 126.

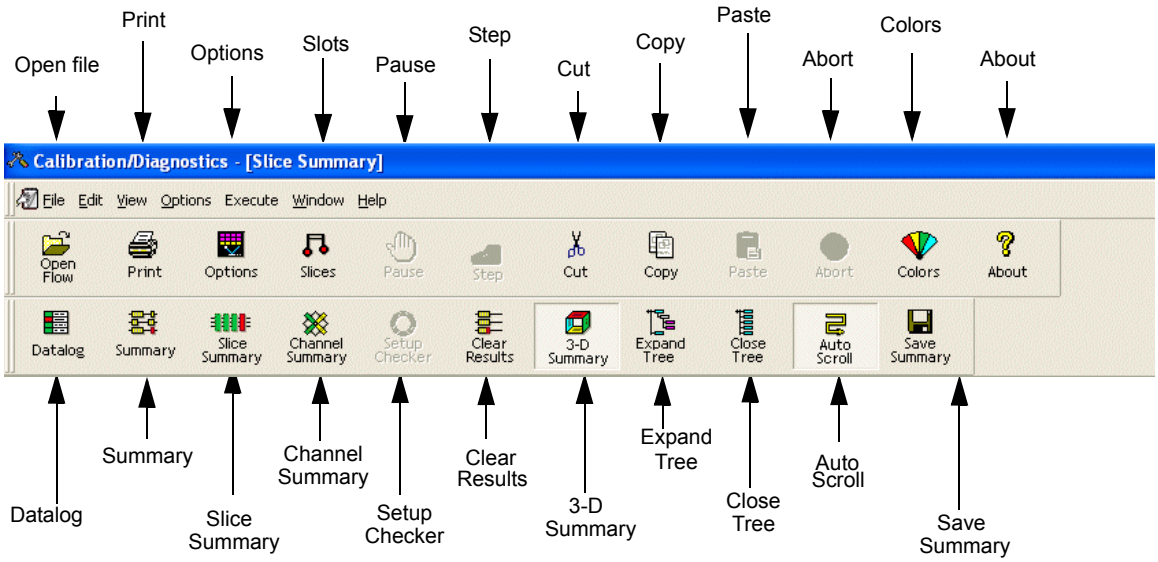
Figure 126. Slice and Channel Summaries



Calibration/Diagnostic Tool Icons

A description of the tool icons located at the top of the Calibration/Diagnostic window, as shown in Figure 127, follows:

Figure 127. Tool Icons



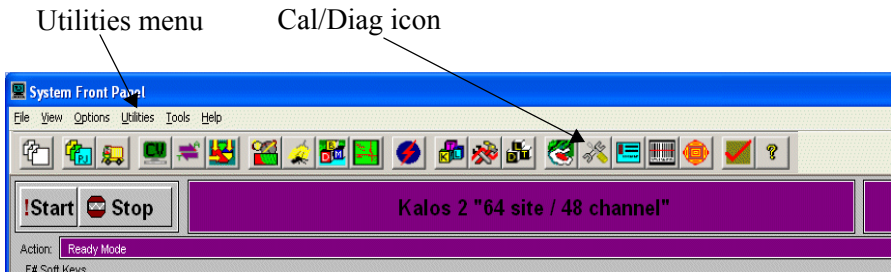
Open file	Brings up a browser to enable selection of a file.
Print	Prints the ASCII file depicting the current test suite(s).
Options	Set up test parameters, datalogging and summary information.
Slices	Select the channels and slots for the current calibration or diagnostic run.
Pause	Pauses the execution of the current running calibration or diagnostic test suite.
Step	Tests each suite manually, stopping after each test.
Cut	Removes the selected text (ASCII representing test suites) from the file and puts it onto the clipboard.
Copy	Duplicates the selected text (ASCII representing test suites) from the file and puts it onto the clipboard.
Paste	Inserts the clipboard at the insertion point.
Abort	Aborts the running calibration or diagnostic.
Colors	Edit the color scheme.

About	Displays the software version of the Calibration/Diagnostic program. (This window must be closed to return control back to the previous window.)
Datalog	Invokes the datalog window.
Summary	Invokes the Summary window.
Slice Summary	Displays the summary information by slice.
Channel Summary	Displays the summary information by channel.
Setup Checker	Displays the channels and slots, chosen for testing, on the loaded diagnostic or calibration program. Note: *This feature is not implemented with this version of Kalos 2*.
Clear Results	Clears the results of the currently loaded calibration or diagnostic routine.
3-D Summary	Indicates how many times a test passed or failed. This is displayed in the summary views.
Expand Tree	Expands all subtests of the diagnostic and calibration routine.
Close Tree	Closes all subtests of the diagnostic and calibration routine.
Auto Scroll	Automatically scroll to the latest result during testing.
Save Summary	Saves the summary information to a text file.

Running Calibration

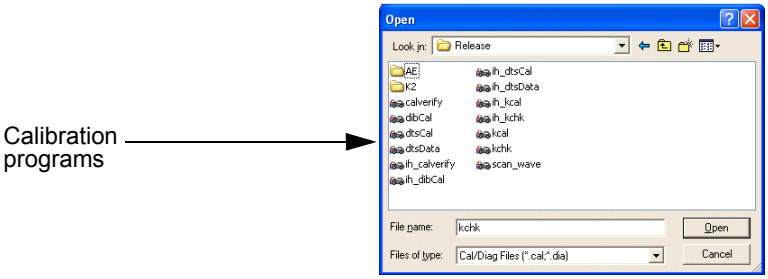
The Calibration program, like Diagnostics, is invoked by single clicking the *Cal/Diag* icon on the System Front Panel, or by selecting *Utilities => CAL DIAG* from the menu bar, shown in Figure 128.

Figure 128. Front Panel Toolbar



Calibration and Diagnostic software programs are located under the *File* menu, inside the Calibration/Diagnostic window, shown in Figure 129.

Figure 129. Calibration/Diagnostics Programs



The standard Calibration program is called **kcal.cal**. The program is located in the **C:\Kalos\bin** directory. Running calibration is required before production testing to prevent inaccuracies and confusion during tests. A 30 minute warm up (looping the kchk) must be performed before running calibration.

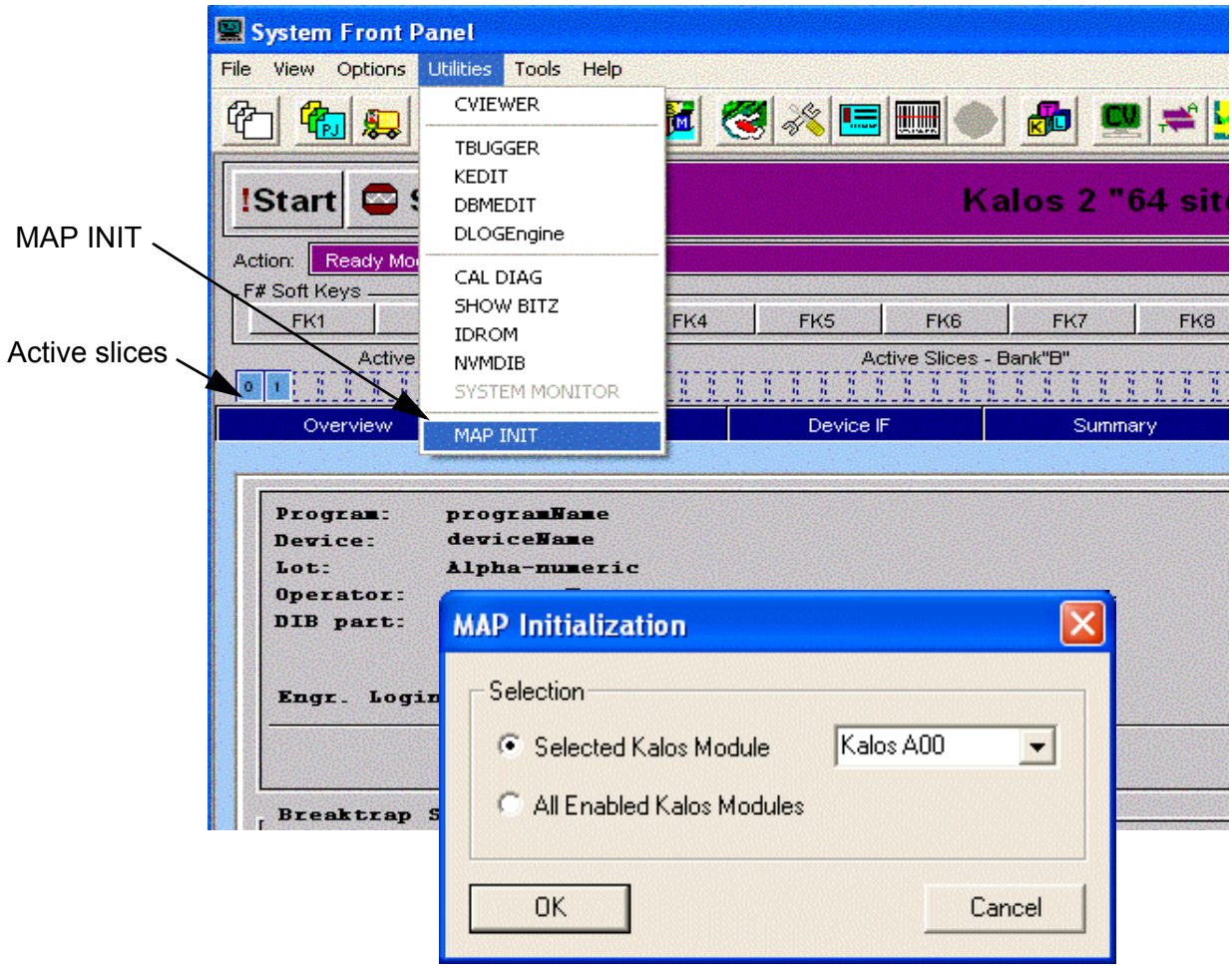
Mapping Active Kalos Slices

Before running maintenance software, the active Kalos slices (Kalos boards) must be mapped. The Kalos 2 Active Slices boxes (see Figure 99) are located on the Front Panel window. A box representing each test board in the test head should be reflected. If not, there may be a problem with communication between the boards and the CPU, or possibly a power supply problem with the Kalos board in the test head.

The MAP INIT selection brings up the MAP Initialization dialog box (see Figure 130) that allows the user to select all slices (most typical) or any one slice. To map the boards manually, click on the *Utilities* pulldown menu and select MAP INIT. Otherwise the interface automatically runs the mapping when the slice is set up by TTarget.

CAUTION
Map INIT will erase the dibcal values.

Figure 130. MAP INIT



Device Testing Procedure

This section provides a step by step example of a basic device test procedure.

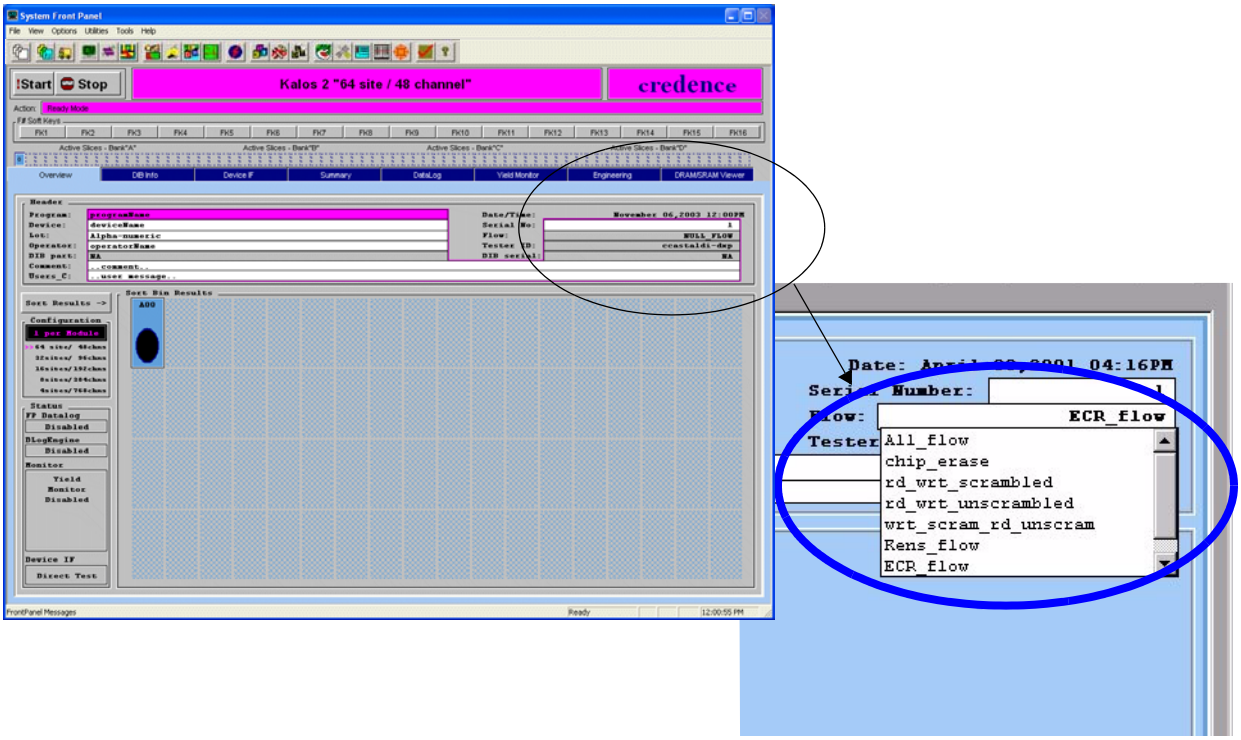
The Load Program operation is used to load an executable test program onto the tester hardware. It invokes a navigation window used for locating and selecting the desired test program file.

Once a test program is loaded, the user may select any flow in the loaded test program for .kbi files by clicking on the *Flow* field (see Figure 131). For .kpj files, the flow cannot be changed except from engineering mode. Clicking in the window displays a pulldown menu showing the defined flows from within the program.

If an automatic prober or handler is used, the Libraries area contains a list of software drivers for peripheral wafer probers and device handlers (refer to "Device IF" on page 123). From this list the user can install the proper driver for the equipment being used. The Status area displays information regarding the status of the installed peripheral device. (Refer to Step 7 in the following setup steps.)

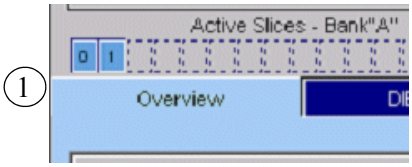
The Wafermap feature is a viewer for displaying the pass/fail results or sorted die categories of selected wafers, plotted within a two-dimensional coordinate system. The Sort Results display the previous and current sort results. This includes the pass/fail condition, its sort category, and the Kalos 2 module it was tested on. The Wafermap feature is accessed by way of the Front Panel Summary property page.

Figure 131. Flow Selection

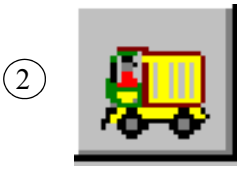


Proceed through the following setup steps to perform device testing:

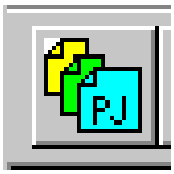
1. Verify that the required Kalos 2 Active Slices appear in the Overview tab.



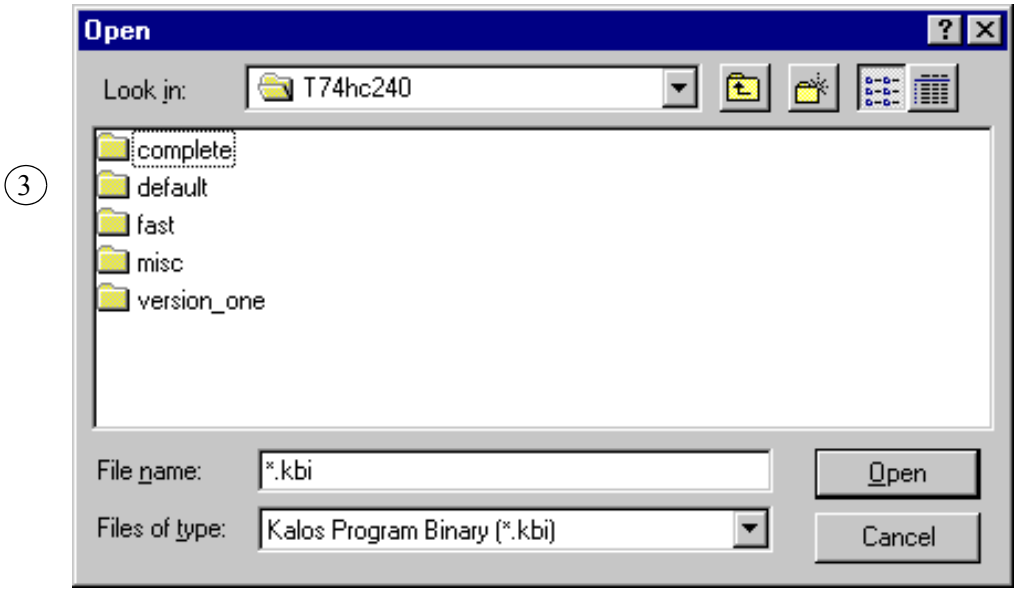
2. Load the test program by selecting the File menu item Load Program, or by clicking on the Load Program icon.



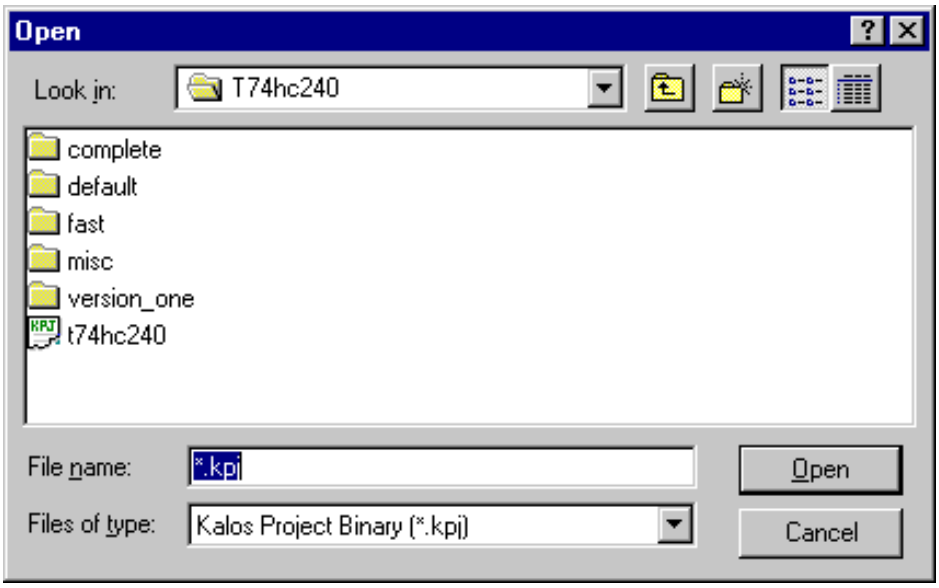
OR, load the project file by clicking the Load Project file icon.



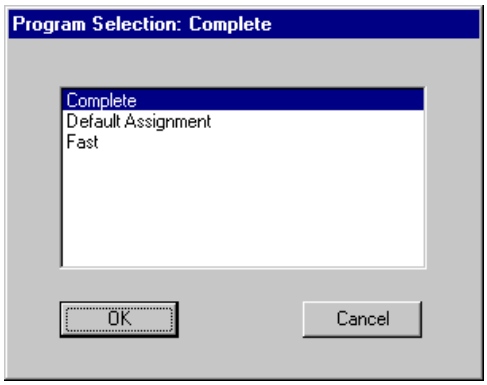
3. Select the test program file using the Open dialog box. Navigate to the folder where the test program is located.



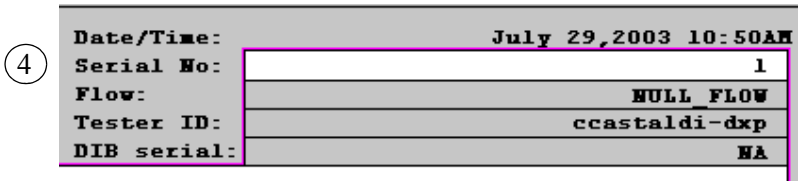
To load the project file, select the appropriate KPJ project folder that appears in the Open dialog box.



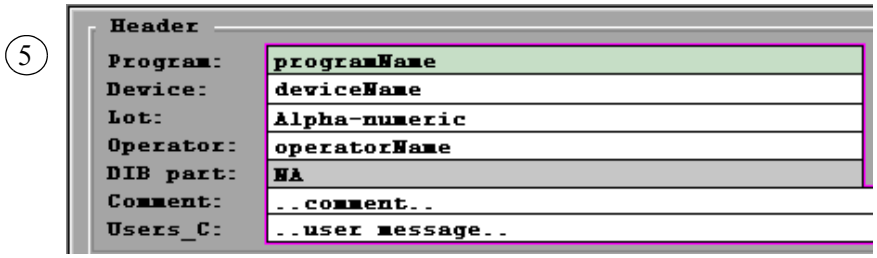
Select the Program Selection from the list, then click on the OK button.



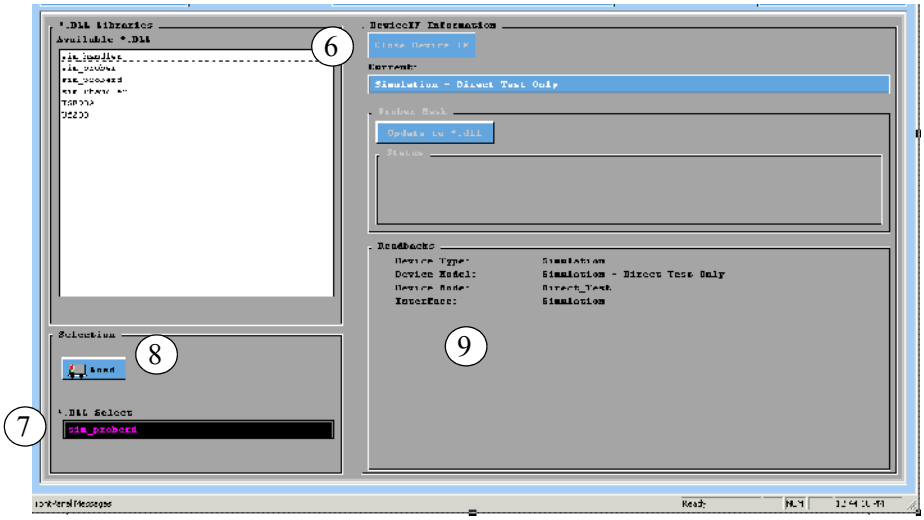
4. Select the test program flow by clicking in the Flow section.



5. Enter the information in the Header section, including Device, Lot, Operator, and Comment.

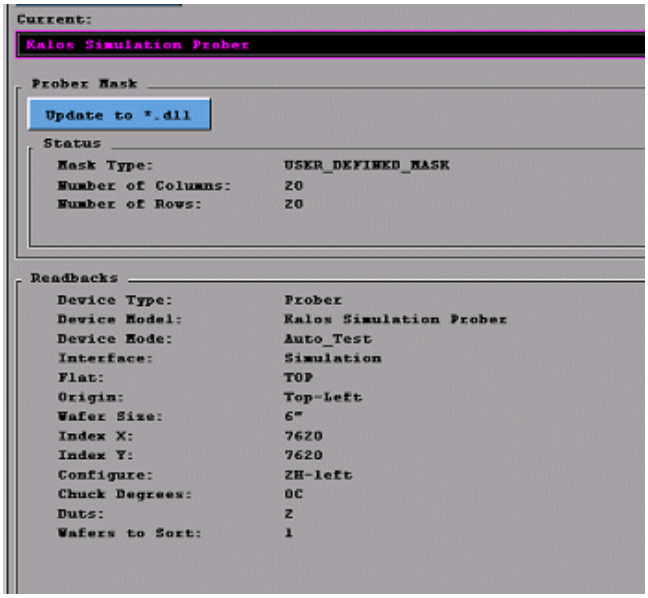


6. Click on the *Clear Device* IF button.



7. Select a device library name. The selection appears in the Selection box.
8. Click on the *Load* button.
9. Any required device input is requested in the dialog box of the selected device. The loaded *.DLL, with its respective coding (implemented by the user), determines if additional input is required. This information could be GPIB device name, list of wafers, number of DUTs to be tested, etc.
10. The device parameters are displayed under the Current heading when device loading is completed.

⑩



The indicator in the upper right hand corner changes from Direct Test to Auto Test.

11. To collect wafermap data during sort, refer to the Wafermap Feature section of this chapter to perform the applicable setup.

12. Perform setup on the prober or handler to be used for device testing.

13. Click on the *Start* button to begin testing.

⑬

⑭

14. For wafer sort: testing completes automatically when the “end of lot” message is signaled by the prober. For handler testing: the *Stop* button must be pressed to end testing. When the *Stop* button is pressed, the following dialog box appears. Select *Yes* to abort (stop) testing, or *No* to continue testing.

The *Clear Device IF* button unloads the software device and returns the tester to Direct Test.

5

KITE UTILITIES

The Kalos Integrated Test Environment (KITE) software provides access to development, debug, and diagnostic utilities This chapter describes each utility and provides information on their functions and usage. KITE utilities consist of the following:

- CView (Console Viewer) Utility
- Test Debugger (TBUGGER) Utility
- Kedit Utility
- Waveform (AWT)
- LDTool
- DBM Editor (DBMEdit) Utility
- DLOGEngine
- Cal/Diag Utility
- ShowBitz Utility
- IDRom Utility
- NVMDIB
- MAP INIT

Overview

The Kalos Integrated Test Environment (KITE) software provides access to development, debug, and diagnostic utilities through a graphical user interface (GUI).

Utilities can be opened (launched) by clicking on the applicable toolbar icon, shown in Figure 132, or from the Utilities pulldown menu located on the menu bar of Front Panel.

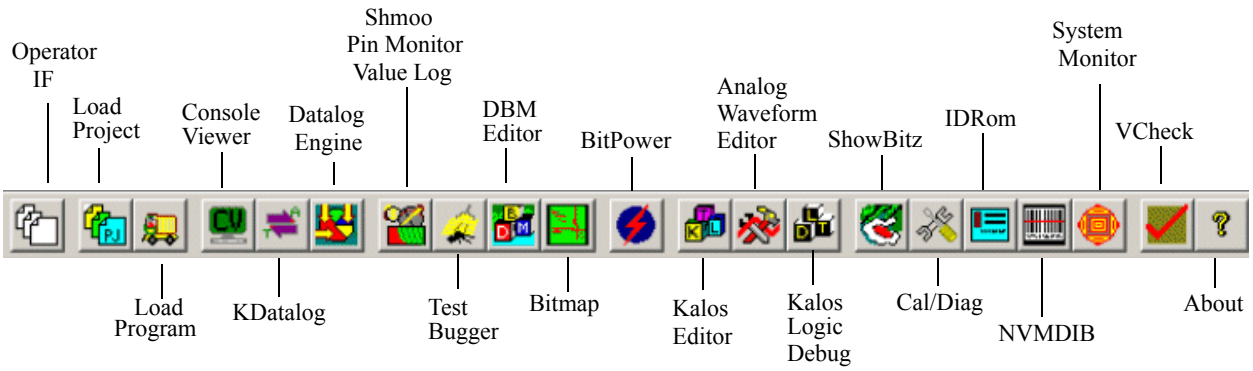
Toolbar

The Toolbar is an arrangement of graphical icon buttons, clustered in functional groups, that execute commands to KITE. These buttons contain the most commonly used commands of the pulldown menu bar.

The Toolbar is located directly below the menu bar of the Front Panel window. If the Toolbar is not present, choose View > Toolbar from the pulldown menu to display it.

Figure 132 shows the layout of the toolbar, and lists the commands executed for each toolbar button. Utilities are invoked by a single click of the left mouse button.

Figure 132. Front Panel Toolbar

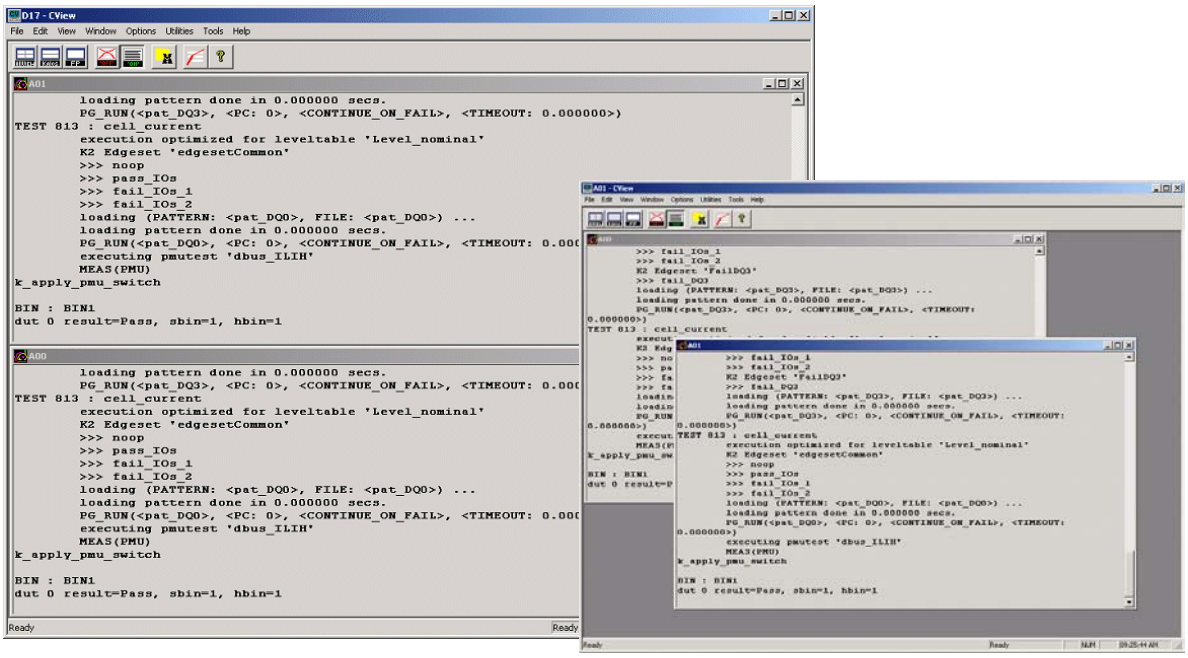


Many of these tools are launched only from engineering mode. Log in to engineering mode from the Front Panel Engineering tab.

CView (Console Viewer)

The CView (Console Viewer) utility (see Figure 133) is a debug viewer for observing communication messages between the CPU of each Kalos 2 board and workstation computer. These communication messages show the processing of events and sequence of execution by the Test Program Executor (TPE). A display panel appears for each active slice.

Figure 133. CView (Console Viewer) Property Page

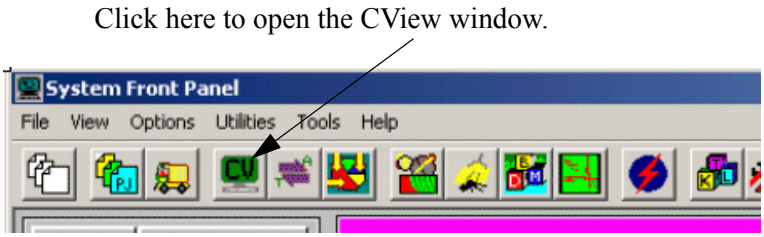


Display for Each Active Slice

CView Window

The CView window displays all program execution activity. It is suggested that the user open the CView window at the start of each session and position the window out of the center of the CRT display, where it can been seen, but not as the main window. The CView utility is accessible in both production and engineering modes. That is, user login is required. Open the CView by clicking the CV icon in the Front Panel window (see Figure 134) or by selecting Utility => CVIEWER from the menu bar.

Figure 134. CView Icon



NOTE — The CView does give some run time overhead, which causes additional run time in production.

Menu and Toolbar

The following are descriptions of the CView property page menu and toolbar options.

File -

- Selected Slice: standard SaveAs selected slice to file.
- All Active Slices: standard SaveAs all active slices to file.
- Exit: closes the application.

Edit -

- Find text.

View -

- All Kalos Slices: show all slices (even if not physically present).
- Kalos (Active) Slices: show only the physical slice that is present.
- FrontPanel (Active) Slices: show only Front Panel enabled slices.
- Clear Selected Slice: only the selected (highlighted) slice is cleared.
- Clear All Slices.

Window -

- Cascade: standard XP display for manual data input (MDI) windows.
- Tile: standard XP display (most commonly used).
- List of available slice windows (click to bring forward).

Options -

- TPE Printf On: enable all messages using TPE Print.
- TPE Printf Off: disable all messages using TPE Print.

- Always On Top: keep CView application on top of all others applications on desktop.

Utilities -

Launch the selected utility application.

Tools -

- Launch the selected tool application.

Help -

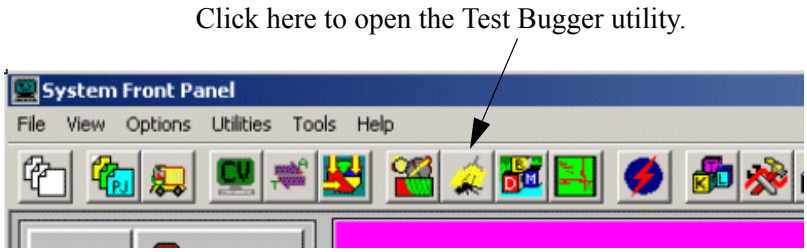
- About CView: standard help window.

Test Debugger

KITE's device debugger, known as Test Debugger, is an interactive utility that allows the user to modify settings, such as levels, timing and flow, within a Kalos test program and immediately return to program execution of the selected slice without the need to recompile. The Test Debugger is accessed from the Front Panel.

The Test Debugger utility is launched by clicking on the *Test Bugger* icon (see Figure 135) or it can be selected (launched) from the Utilities *TBUGGER* menu item.

Figure 135. Test Bugger Icon



All Test Debugger editing property pages have some common operations for getting, setting, and selecting the respective resource for editing. These operations are located in the property page's control area (top of the selected page).

The *Get* and *Set* buttons, if available for the respective property page, are for updating or sending the utilities' current data table. Some of the property pages have an *Apply* button, which is a superior set operation. *Apply* executes the set function and then applies the specific resource table to the Kalos 2 hardware.

The *Break Test* button, if available for the respective property page, allows users to select the Front Panel's Break Test resource or select a specific resource (from the currently selected slice program) for editing.

Refer to the Test Debugger chapter in this manual for complete information and details on the Test Debugger utility.

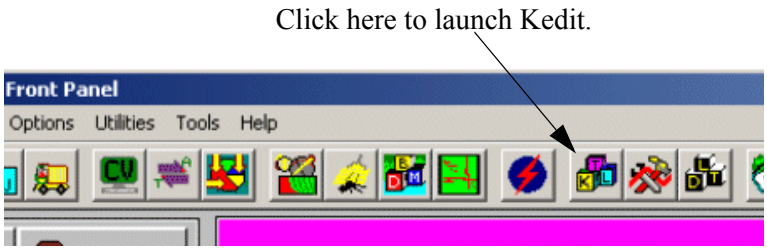
Kedit

The Kedit utility is a Kalos 2 supplied text editor. Kedit is used to generate, edit, and compile test programs.

Launching Kedit

The Kedit utility is accessible only in Engineering mode. That is, user login is required. Kedit can be launched by clicking on the KTL icon located on the toolbar of Front Panel (see Figure 136) or by selecting *Utilities* => *KEDIT* from the menu bar.

Figure 136. Kedit Icon



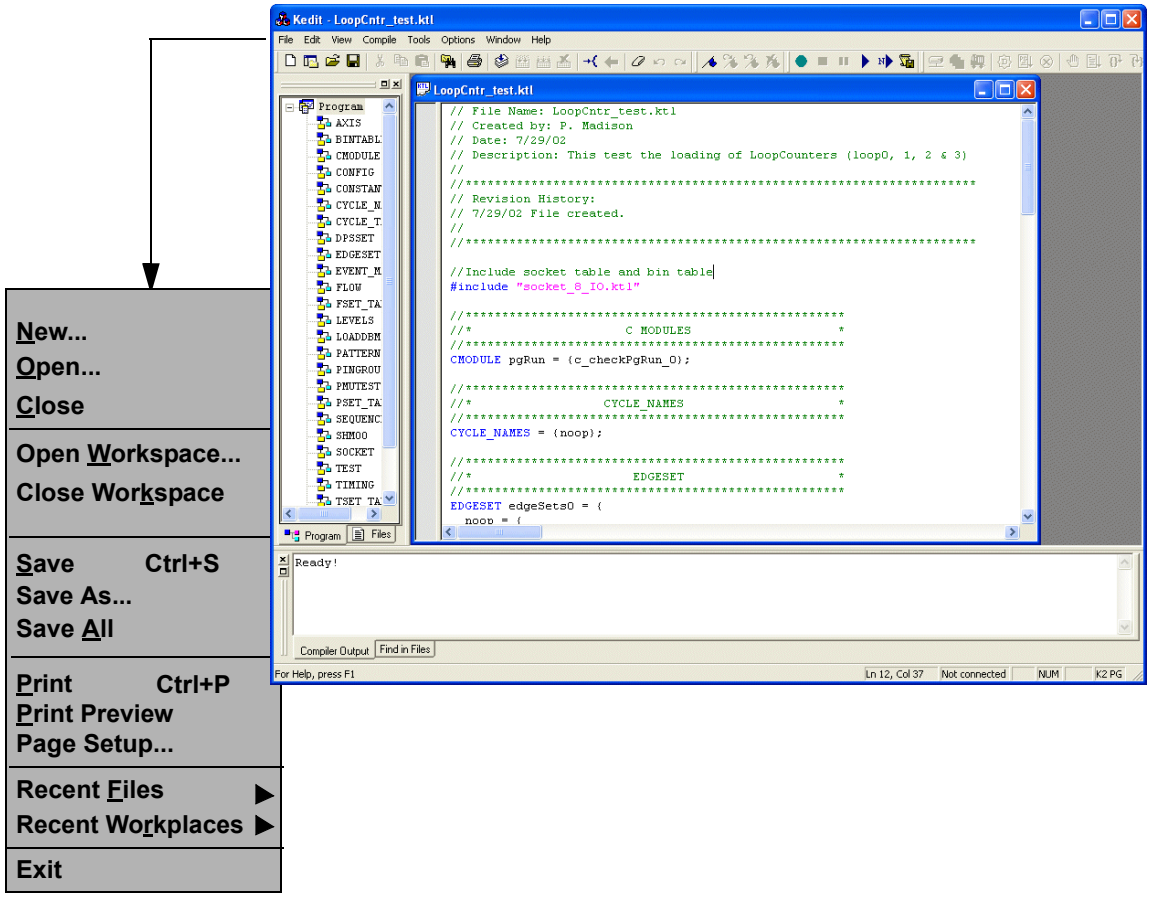
Program Loading

Once the editor is launched, click the left mouse button on the File pulldown menu (see Figure 137). From this pulldown menu a program can be selected for loading. Options include:

- New to create a new file
- Open to load a file
- Open Workspace to edit an existing file

Additional options are provided to save, print, close, and review recent files. Refer to the Kedit section in the Test Program Definition chapter in this manual for in-depth information on the Kedit utility.

Figure 137. Kedit (Text Editor)



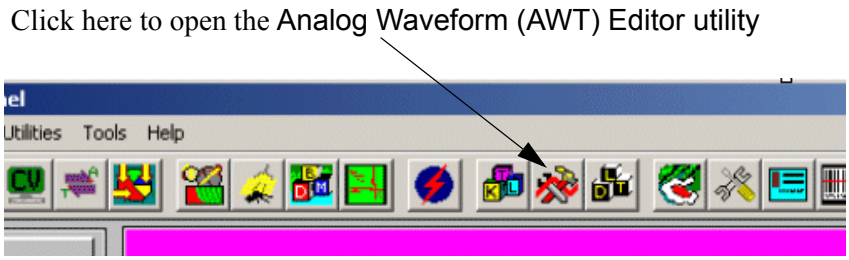
Waveform (AWT)

The Analog Waveform (AWT) Editor, also know as the Analog Wavetool is a graphical tool for manipulating waveforms. This section includes:

- Operation
- Waveform Filetypes
- User Interface

The Analog Waveform (AWT) utility is launched by clicking on the *Analog Waveform (AWT) Editor* icon (see Figure 138) or it can be selected (launched) from the Utilities *Waveform (AWT)* menu item.

Figure 138. Analog Waveform Icon



Introduction

The graphical Waveform tool is based on a stack system, like a postfix (reverse Polish notation) pocket calculator.

With the Waveform tool, you can:

- Create various types of waveforms.
- Read from and write to waveform files.
- Modify waveforms using the Analog Wavetool's extensive toolset, including the following:

  - *Display cross-hair cursors that are mouse draggable with* Δx *and* Δy *values.*

  - Zoom and pan in both x and y directions.

  - Select the number of waveforms to display.

  - Perform Digital Signal Processing (DSP) operations and measurements on waveforms.

- Read from and write to waveform resources on Credence high-performance testers.
- Create and execute scripts.

The Analog Wavetool has an extensive library of DSP routines, waveform generation templates, and multiple waveform displays to output a variety of different waveform formats.

General

Analog Wavetool is a cross-platform tool that currently includes Windows XP operating systems.

The user interface incorporates the Microsoft User Interface Guidelines, with screens, dialogs and a menu structure that adhere to Windows standards.

Creating a Waveform

To create a waveform:

1. Choose ***File*** > ***New*** (or click the ***New*** File icon).
2. Choose the waveform type
3. Click OK.

Establishing the Current Directory

Use the ***File*** > ***Save As*** menu item to establish the current directory. The Analog Wavetool remembers this directory until you change it.

Opening a Command File

The ***File*** > ***Open*** menu item is reserved for opening waveforms only. To open a command file in Analog Wavetool, select the desired script from the ***Tools*** menu drop-down list.

Command files in Analog Wavetool have both the *.cmd* and *.aws* extensions. Since the *.cmd* extension conflicts with a Windows predefined extension, the *.aws* extension is added. However, both are recognized as command files in Analog Wavetool.

In addition to opening a specific command file from those listed on the ***Tools*** menu, the ***Tools*** > ***Script*** > ***Execute*** menu item can also be selected. Selecting this item prompts you for the command file to execute. This can also be done through the **Execute a Script** toolbar icon.

Saving a Waveform

Analog Wavetool has only one save option: ***File*** > ***Save As***.

Connecting to a Tester or Emulator

Not Supported at present time.

Setting Preferences

This category includes the following features:

- Options are set by way of the ***Tools*** > ***Options*** menu item.
- To set the number of panes (sub windows) to display, use ***Tools*** > ***Options*** > ***Display*** tab.
- To view selected markers, use ***View*** > ***Markers*** menu item or the ***Select Marker Type*** icon.
- To turn on/off the scripting, use ***Tools*** > ***Script*** > ***Record*** menu item or click on ***Begin Script Recording*** icon in the toolbar.

Undo and Redo

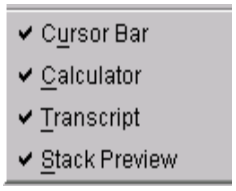
Undo and redo any operation using the ***Edit->Undo*** and ***Redo*** menu items.

NOTE — Undo and redo cannot be applied when scripting is on.

Custom Zoom

To select the zoom rectangle in the pane after choosing the ***View*** > ***Custom Zoom*** menu item, click and drag the left mouse button, or use the ***Custom Zoom*** toolbar icon.

View Options



Using ***View*** menu item allows the user to pick and choose among the four Analog Wavetool components: Cursors Bar, Calculator, Transcript Pane and Stack Preview. A check mark by the item signifies that it will display; no check mark means that it will not display.

Online Help

Online help is available by way of the ***Help*** menu item or toolbar icon.

No System Cursors

The Analog Wavetool does not provide default system cursors. All cursors must be created manually (and can be deleted). This is done by right-clicking in the Waveform Graphics pane and selecting ***Create New Cursor***.

Flexible Cursor Delta Boxes

To display delta information, select any two cursors.

Cursor Pop-up

The cursor pop-up menu features of Analog Wavetool 2.0 behaves as follows:

- ***Edit*** > ***Undo*** *or* ***Redo Create cursor*** menu item or toolbar icon is used to undo or redo create cursor.
- Cursor menu items also include:
  - ***Set as left cursor*** *and* ***Set as right cursor*** to establish the delta cursor.
  - **Change name** to change the name of a cursor.
  - **Change color** to change the color of a cursor.

X Scale and Y Scale

Each displayed waveform contains the X and Y Scale (with Scale Factor selection) and Units parameters.

Paging and Scrolling in the Waveform Graphics Pane

The pop-up menu that appears when you right-click on the horizontal and vertical scroll bars have several items that provide more control over waveform placement:

- Page Up and Down
- Scroll Up and Down

In addition, the scroll bars on the edges of the waveform graphic pane (see Figure 139) scroll all panes simultaneously so that you can view any waveform without rotating and resizing. There is also a display option that enables you — for performance reasons — to opt to *real-time* scroll only one patch at a time (the other patches snap to the new scroll position upon releasing the mouse button). This is the default.

Calculator Pane

Access the functions of the calculator items by left-clicking on the buttons.

Operation

The Analog Wavetool is based on a stack principle. It works like a postfix pocket calculator.

When a waveform is read — either from a file or directly from a tester — it is put onto the top of the stack (TOS).

Operations work on waveforms from the top down. For example, operations targeting *one* operand use the waveform at the top of stack. Operations targeting *two* operands use the top *two* elements in the stack, and so on.

NOTE — Putting too many waveforms onto the stack causes the waveform(s) at the bottom of the stack to be lost with no warning message.

Waveform Filetypes

The filetypes that the Analog Wavetool deals with can be divided into two categories:

Read-in Filetypes

AWAV

(*.awav) An ASCII *awav file.

AWG

(*.awg) An ASCII Kalos 2 AWG formatted waveform.

CAP

(*.cap) A raw binary file of longs from the Kalos 2 capture processor. This file is generated when using the cp_store_data primitive.

NOTE — The file-read function used to read capture processor files is a generalized file reader and reads any file, regardless of whether it contains capture-processor data or not. Reading an arbitrary file produces unexpected results.

Spice

(*.sp) A spice waveform file.

Save As Filetypes

Saving a waveform writes the TOS waveform to the assigned file name. There are four filetypes to which you can save a waveform:

AWAV

This filetype is automatically given an extension of .awav unless a different extension is specified.

AWG - Kalos 2 series only.

Save as an AWG-ready waveform. If an extension is provided, it is kept, otherwise the *.awg* extension is appended to the name when the file is written. This is user readable and editable with any standard ASCII editor (EDT, VI, EMACS, CRISP, Notepad, etc.).

Select the target AWG (HF, LF) and the optimization level (low noise, low distortion).

Only HF and LF AWG file formats are supported.

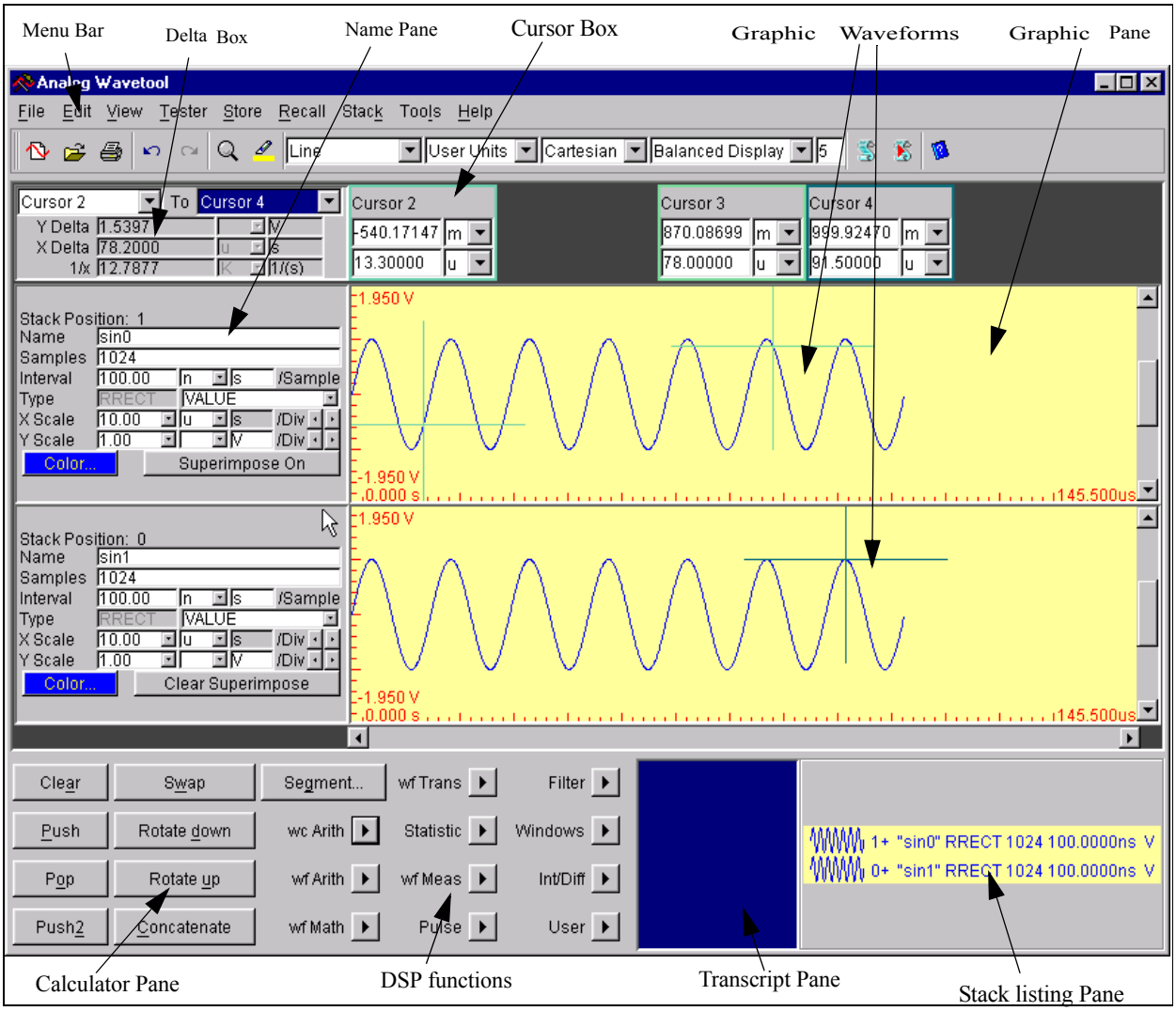
User Interface

The Analog Wavetool window contains the following major areas:

- Menu bar across the top
- Toolbar with icons for common tasks
- Delta box for information pertaining to any two selected cursors
- Name pane for information related to the displayed waveforms
- Cursor strip for the cursors
- Graphic pane for displayed waveforms
- Calculator area for modifying waveforms
- Transcript pane for errors, warnings and test output

All major areas of the Analog Wavetool window are shown in Figure 139.

Figure 139. Analog Wave Tool Window



Throughout the Analog Wavetool, there are several Parameter-Input dialogs, or *data entry dialogs*. Any time one of these dialogs is displayed, all other functions of the Analog Wavetool are inhibited until either **Accept** or **Cancel** is clicked in the dialog (or tab to the button selection and press the **Enter** key). Pressing the **Esc** key also cancels the dialog.

A few additional tips:

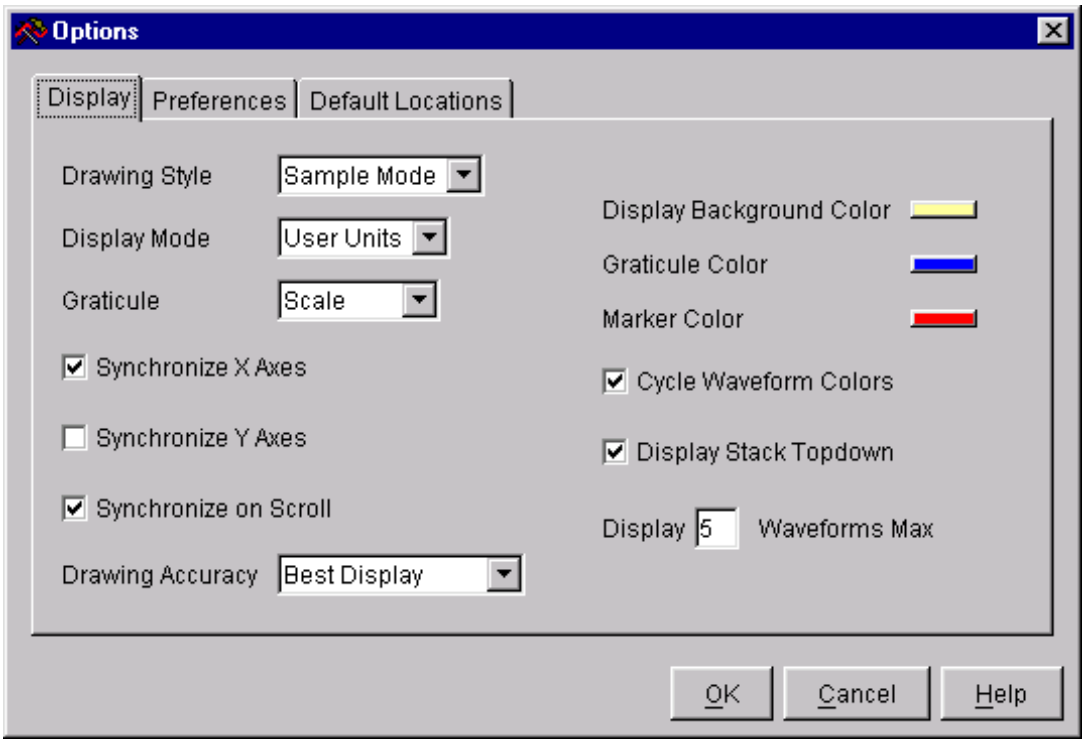
- Parameter-Input dialogs remember values from one call to the next. If a value is set in a dialog box and the same function is performed again, the same dialog box comes up with the values last accepted. The exceptions to this are the names of waveforms and cursors. New default names are generated each time the function is accepted.
- Pressing Ctrl-a: selects the entire parameter.
- Pressing Ctrl-h: backspaces and deletes the previous character.

Setting Options

To specify preferences for items shown in the Options window (see Figure 140):

1. Choose the menu item **Tools** > **Options**.
2. Click the tab that corresponds to the item you wish to set.
3. Adjust settings.
4. Click **OK**.

Figure 140. Options Window

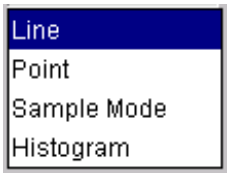


To choose options for display:

Select the **Display** tab from the Options window.

Drawing Style

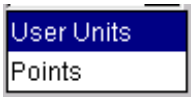
There are four waveform Drawing Styles in the Options window.



Line — Basic dot-to-dot mode where each data point is connected by a straight line.
Points — Displays only the data points.
Sample Mode — Imitates a DAC output. In this mode, the display magnitude does not change until the next data point.
Histogram — A basic bar code chart centered around zero.

Display Mode

The Display mode for the X axis in the Options window has two choices: User Units or Points.



User Units — Displays the X axis in terms of user interval units (sample interval). If user interval units are seconds, display is in the time domain.

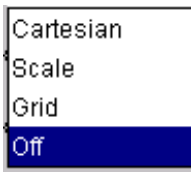
Points — Changes all X axes to Points mode (samples per division).

In User Units mode, the waveforms are displayed at the same scale, if the units are the same. In Points mode, units are ignored. This means that in user units mode, a single cycle waveform sampled at 5 ns intervals with 800 points graphically looks the same as a single cycle waveform sampled at 10 ns intervals with 400 points. In Points mode, however, the first of these two waveforms are displayed at twice the width of the second.

Graticule Setting

To select the type of graticule in the Options window, when displaying with a waveform patch:

1. Choose one of the following four types:



Cartesian — Sets the scales for the X axes at the bottom of the waveform patches.

Scale — Sets the scales for the X axes in the center of the waveform patches, as is Y axis label.

Grid — Overlays a grid of lines on the waveform panes. The distance between lines is equal to the X and Y scale factors.

Off — Turns off the graticules.

2. Click **OK**.

Stack Display Order

To choose the stack display order:

Select the *Display Stack Topdown* checkbox in the **Tool** > **Options** window, to display the stack from the top down. Deselect the checkbox to display the stack from the bottom up.

Synchronize Y Axes

The Synchronize Y Axes option is controlled by an on/off toggle switch. When the **Synchronize Y Axes** checkbox in the **Tool** > **Options** window is selected, all waveforms on the stack with Y units that match the *Y units* of the TOS are synchronized. In other words, when the TOS waveform is scaled and/or scrolled, all matching waveforms scale and scroll along with it. This enables direct comparison of waveforms and is useful when combined with the superimpose feature (described later in this section).

When off, all Y axes parameters are maintained separately:

1. Select or deselect the **Synchronize Y Axes** checkbox from **Tools**> **Options**> **Display** window. (See Figure 140.)
2. Click **OK**.

Synchronize on Scroll

This on/off toggle switch is off by default. When the feature is turned *on*, all patches synchronize simultaneously on a horizontal or a vertical scroll in any given patch.

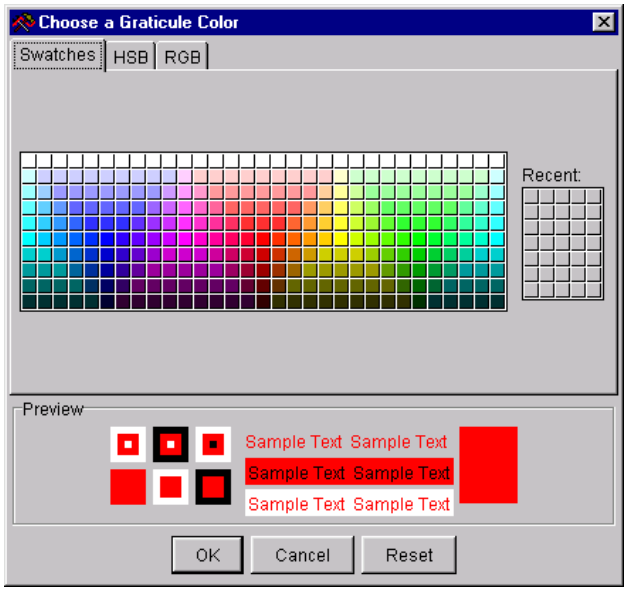
NOTE — To work on Y axis, the *Synchronize Y Axes* feature must be turned on.

Background, Graticule, or Marker Color

To specify the background, graticule, or a marker color:

1. Click the marker color button in **tools> Options> Display** window. (See Figure 140.)
2. Using the color palettes, slider bars and color value fields, choose or create the background color from the *Choose a Graticule Color* window, as shown in Figure 141.

Figure 141. Marker Color Window



1. Click **OK**.
2. Click **OK** again.

CWaveform Colors

To turn automatic color incrementing on/off:

1. Select or deselect the **Cycle Waveform Colors** checkbox from **tools> Options> Display** window.
   With the feature turned *on*, successive waveforms pushed onto the stack appear in different colors. If the feature is *off*, automatic color selection is turned off and the color is reset to the default color selection.
2. Click **OK**.

Maximum Waveform Display

To set the maximum number of waveforms display:

1. Enter a value for X in the **Display (...) Waveforms Max** item in **tools> Options> Display** window.
2. Click **OK**.

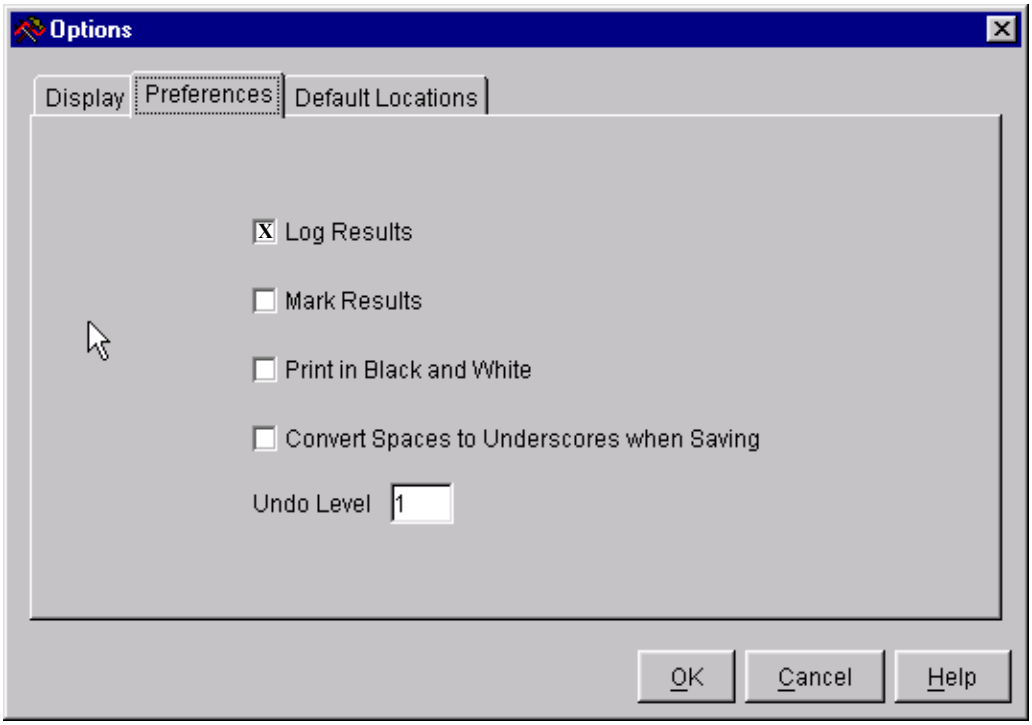
Log Results in the Script File

If scripting is turned on, the option of writing comments to the currently open script file is available. With this logging feature on, any wave tool function that prints results in the transcript pane also prints the results to the script file.

To turn the Log Results feature on/off:

1. Select the **Preferences** tab from the options window, as shown in Figure 142.

Figure 142. Preferences Window Options



2. Select or deselect the **Log Results** checkbox.
3. Click **OK**.

Mark Results

The results of several waveform measurements (most of the pulse characteristics) can be displayed as results markers on the waveform(s). The generation of these results markers can be turned on or off.

To turn results marker generation on/off:

1. Select the **Preferences** tab from **Tools** > **Options** window.

2. Select or deselect the **Mark Results** checkbox.
3. Click **OK**.

Convert Spaces to Underscores

The Analog Wavetool can automatically convert the spaces to underscores.

To convert spaces to underscores:

1. Click the **Preferences** tab from **Tools** > **Options** window.
2. Select **Convert Spaces to Underscores**.
3. Click **OK**.

Print in Black and White

To print in black and white:

1. Choose the menu item **Tools** > **Options**.
2. Click the **Preferences** tab.
3. Select **Print in black and white**.
4. Click **OK**.

Undo Level

To set the maximum number of times you can undo previous operations:

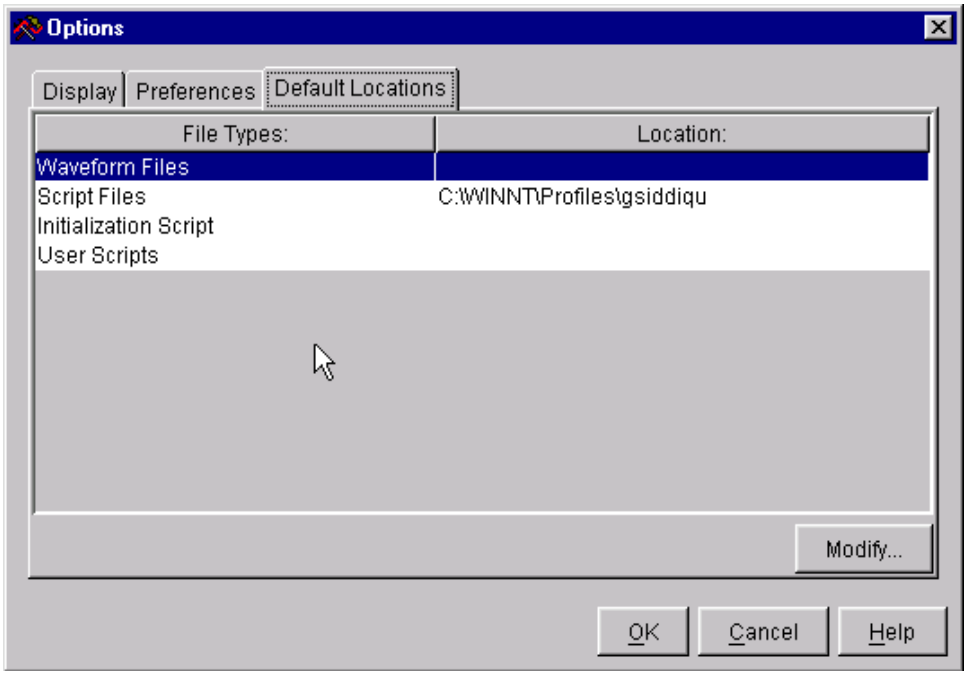
1. Choose the menu item **Tools** > **Options**.
2. Click the **Preferences** tab.
3. At the **Undo Level** tag, enter a number between 0 and 32.
4. Click **OK**.

File Locations

To see the default location of different types of files:

1. Choose the menu item **Tools** > **Options**.
2. Click the **Default Locations** tab (see Figure 143).

Figure 143. Default Location Window



To change the storage location of any or all of the filetypes:

1. Click on the file type, then click the **Modify** button.
2. Browse for the desired storage location.
3. Click **OK**.
4. Click **OK** again.

NOTE — Selecting the User Scripts item and clicking the Modify button brings up a slightly different dialog box that allows you to select multiple directories.

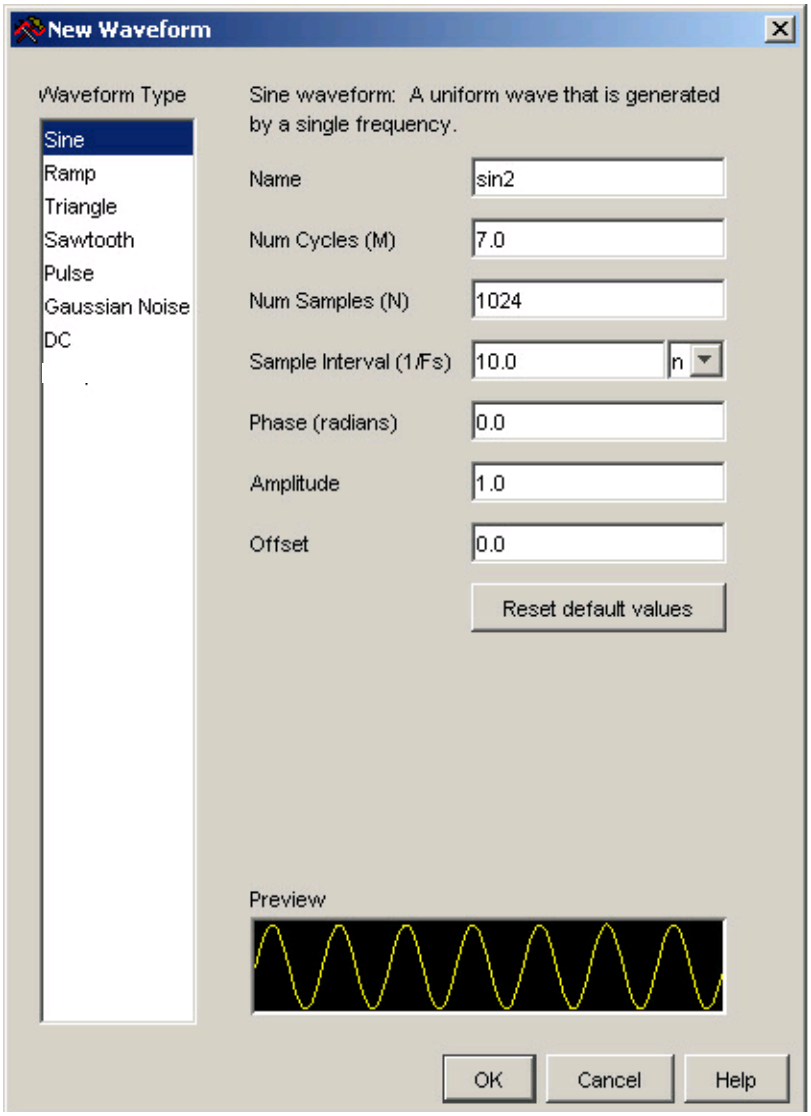
Click **OK** after selecting the directory.

Creating a Waveform

To create a waveform:

1. Choose **File** > **New**...or... click the **New File** icon on the toolbar to open the new Waveform window, shown in Figure 144.

Figure 144. New Waveform Window



2. On the left side of the dialog, select a waveform type.
3. On the right side of the dialog, enter the parameters for the waveform you are creating.
4. Click **OK**.

Waveform Parameter Details

The sine waveform parameters are described in Table 8.

Table 8. Sine Waveforms

Parameter	Meaning
Name	Name associated with the waveform/wavelet.
Num Cycles (M)	Number of waves to display. One cycle equals one complete wave.
Num Samples (N)	Number of samples distributed over M cycles.
Sample Interval (1/Fs)	Time required to elapse between samples.
Phase (radians)	Fraction of the period of time that is required to elapse with respect to a fixed datum point.
Amplitude	Magnitude of variation in a changing quantity from its zero value.
Offset	Relative location of zero on the Y axis to start the drawing of a waveform.

The ramp waveform parameters are described in Table 9.

Table 9. Ramp Waveforms

Parameter	Meaning
Name	Name associated with the waveform/wavelet.
Sample per Ramp	Number of points per ramp used to create the waveform.
Sample Interval (1/Fs)	Time required to elapse between samples.
Start Voltage	Initial voltage of ramp waveform.
Stop Voltage	Final voltage of ramp waveform. If stop voltage is lower than start voltage, the resulting waveform will have a negative slope.
Start Delay (sample time)	The duration to maintain the start voltage after which the ramp decrements/increments toward the stop voltage.

The triangle waveform parameters are described in Table 10.

Table 10. Triangle Waveforms

Parameter	Meaning
Name	Name associated with the waveform/wavelet.
Num Cycles (M)	Number of complete waves to display. One cycle equals one complete wave.
Samples per Cycle	Number of points per cycle used to create the waveform.

Table 10. Triangle Waveforms *(Cont.)*

Parameter	Meaning
Sample Interval (1/Fs)	Time that is to elapse between samples.
Start Delay	Length of time to wait before beginning the sample.
Rise Time	Time required for the output of a circuit to change its output from a low voltage level (0) to a high voltage level (1) after the change starts.
Fall Time	The measure of time required for the output of a circuit to change its output from a high voltage level (1) to a low voltage level (0) after the change starts.
Amplitude	The magnitude of variation in a changing quantity from its zero value.
Offset	The relative location from zero on the Y axis at which to begin the drawing of the waveform.

The sawtooth waveform parameters are described in Table 11.

Table 11. Sawtooth Waveforms

Parameter	Meaning
Name	Name associated with the waveform/wavelet.
Num Cycles (M)	Number of complete waves to display. One cycle equals one complete wave.
Samples per Cycle	Number of points per cycle used to create the waveform.
Sample Interval (1/Fs)	Time that is to elapse between samples.
Start Delay	Length of time to wait before beginning the sample.
Rise Time	Time required for the output of a circuit to change its output from a low voltage level (0) to a high voltage level (1) after the change starts.
Amplitude	Magnitude of variation in a changing quantity from its zero value.
Offset	Relative location from zero on the Y axis at which to begin the drawing of the waveform.

The pulse waveform parameters are described in Table 12.

Table 12. Pulse Waveforms

Parameter	Meaning
Name	Name associated with the waveform/wavelet.
Num Cycles (M)	Number of complete waves to display. One cycle equals one complete wave.
Samples per Cycle	Number of points per cycle used to create the waveform.
Sample Interval (1/Fs)	Time that is to elapse between samples.
Start Delay	Length of time to wait before beginning the sample.
Rise Time	Time required for the output of a circuit to change its output from a low voltage level (0) to a high voltage level (1) after the change starts.
Pulse Width	The width - measured in time - of the sample pulse.
Fall Time	Time required for the output of a circuit to change its output from a high voltage level (1) to a low voltage level (0) after the change starts.
Amplitude	Magnitude of variation in a changing quantity from its zero value.
Offset	Relative location from zero on the Y axis at which to begin the drawing of the waveform.

The Gaussian noise waveform parameters are described in Table 13.

Table 13. Gaussian Noise Waveforms

Parameter	Meaning
Name	Name associated with the waveform/wavelet.
Num Samples (N)	Number of samples to take in one cycle.
Sample Interval (1/Fs)	Time that is to elapse between samples.
Seed (must be odd)	Starting value that will be used to randomly generate the waveform.
Mean	Average value of the total number of waveforms.
Standard Deviation	Average amount of variance from the mean.

The DC waveform parameters are described in Table 14.

Table 14. DC Waveforms

Parameter	Meaning
Name	Name associated with the waveform/wavelet.
Num Samples (N)	Number of samples to take in one cycle.
Sample Interval (1/Fs)	Time that is to elapse between samples.
Offset	Relative location from zero on the Y axis at which to begin the drawing of the waveform.

Opening a Waveform File

Opening a waveform file loads the file at the top of the stack.

To open a waveform from a file:

1. Choose **File** > **Open**...or... click the **Open File** icon on the toolbar.
2. In the **Files of Type** field, specify the *type of waveform* you wish to open.
3. Browse for the specific waveform file you wish to open.
4. Double-click the filename...or... select the filename and click the **Open** button.

Working with Cursors

Cursors allow you to make measurements on waveforms. They appear in the Waveform graphic pane as cross-hairs. The vertical part of the cross-hair follows the pointer; the horizontal part of the cross-hair always tracks the Y data value for the data point closest to the vertical part of the cross-hair. Each cursor has a cursor box, displayed above the waveform graphic pane. Cursors and their cursor boxes track together; when you move one, the other moves as well (see Figure 146).

Cursor Boxes

A cursor's corresponding cursor box is located as directly as possible above its cursor. If a cursor is off screen (to the left or the right), the cursor box corresponding to that cursor remains on screen, but at the side of the screen to show in which direction you must pan to find the cursor.

If a cursor is attached to a waveform that is not currently displayed (a waveform that is far enough into the stack that it is not being drawn), the cursor box remains displayed, but the cursor will be invisible. In order to make the cross-hair cursor visible, you must rotate the waveform stack up or down until the waveform is visible.

If two or more cursors are close to each other, the boxes may not have enough room to be directly above the cursors. In this case, each cursor box shuffles around to be as near as possible to its cursor without any cursor boxes being hidden. If there is not room to display all of the cursor boxes, the boxes furthest to the right do not display.

Each cursor box contains a label, a Y value, and an X value.

Label — The first item in the box: the name of the cursor.

Y Value — The Y value at the current cursor location. Changing this value changes the data point.

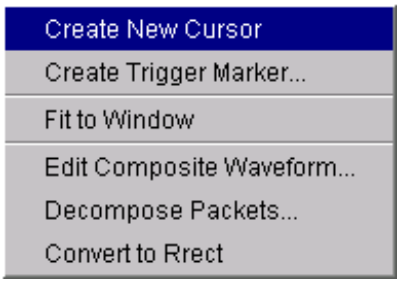
X Value — The X value at the current cursor location. Changing this value moves the cursor.

Creating a Cursor

To create a cursor:

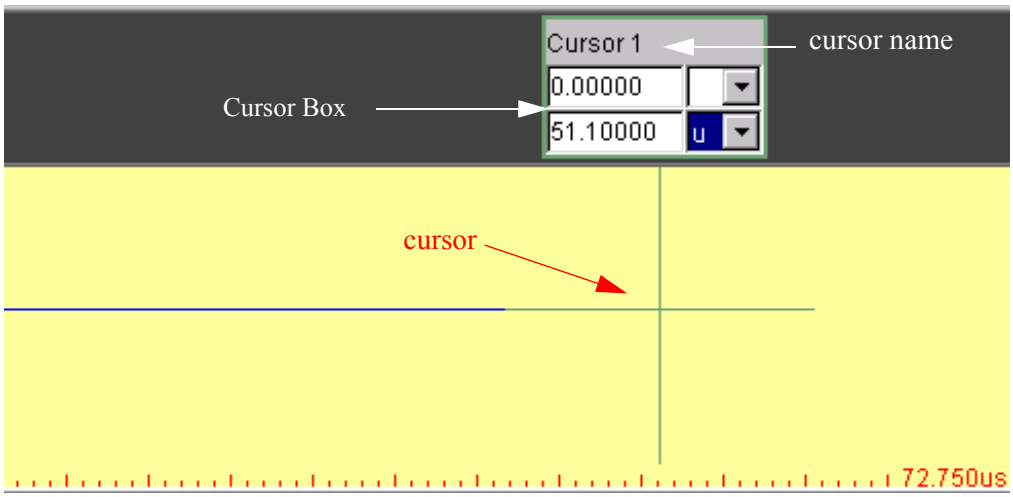
1. Right click in the patch that contains the waveform to which you want to attach a new cursor.
2. From the pop-up menu, choose **Create New Cursor**, as shown in Figure 145.

Figure 145. Cursor Menu



3. Enter the name of the new cursor, as shown in Figure 146

Figure 146. New Cursor



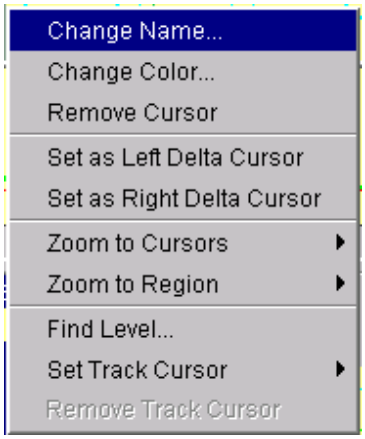
4. Click **OK**.

Modifying a Cursor

To modify a cursor:

1. Right click on the label of the cursor box or near the vertical cross-hair of the cursor to display a pop-up menu list, as shown in Figure 147.

Figure 147. Cursor Menu

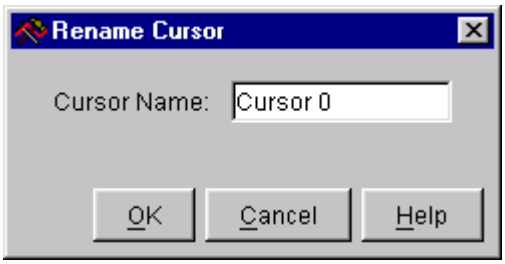


The pop-up menu contains the name of the cursor. Thus, a cursor can be identified without moving it. This is done by pressing the right mouse button near the vertical cross-hair of the cursor.

2. Using the guide below, choose the action to perform the desired changes.

Change Name — Allows you to rename the cursor, as shown in Figure 148.

Figure 148. Change Name Window



Change Color — Enables you to choose a new cursor color from a color palette.

Remove Cursor — Deletes a cursor.

Set as Left Delta Cursor — Sets the selected cursor as the left cursor in the Delta area (upper left corner of tool) for comparison.

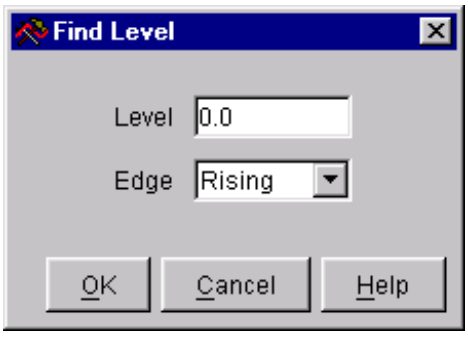
Set as Right Delta Cursor — Sets the selected cursor as the right cursor in the Delta area (upper left corner of tool) for comparison.

Zoom to Cursors — Adjusts the X scale factor and position such that the waveform is centered between the cursors and the cursors are one minor division (tic mark) from each end. If more than two cursors are defined, a list of cursors is provided. If the two cursors are on the same data point, the scale is adjusted so that one sample interval fills the entire display.

Zoom to Region — This works the same as zoom to cursors but the Y scale and position are adjusted as well. The waveform is centered between the minimum and maximum data values included between the cursors. The maximum and minimum values are one minor division from the top and bottom of the display patch, respectively.

Find Level — Prompts for a level and an edge (rising, falling, or either), as shown in Figure 149.

Figure 149. Find Level Window



The Find Level window option allows for positioning of the cursor at the next location in the waveform that crosses the level in that direction. If the cursor is not assigned to a waveform, this operation assigns it to the top of stack waveform.

Set Track Cursor — Provides a list of other cursors. Selecting *None* turns tracking off. When a cursor is set to track another, it maintains the same relative X value as the cursor being tracked. The cursor tracks the original cursor when the original cursor is moved. Cursors can be chained (for example, cursor B tracks cursor A and cursor C tracks cursor B). The act of setting one cursor to track another is not by default reciprocal. Setting cursor A to track cursor B does not cause cursor B to track cursor A. You can move cursor B by itself or move cursor A with B tracking it and maintain the same relative X separation. In order to have cursor A track cursor B and B track A, you must set each tracking separately.

Remove Track Cursor — Returns the track cursor to its native state.

Grabbing and Moving a Cursor

To grab and move a cursor:

1. Place the mouse pointer on or very near the cross-hairs (within ten pixels or about an eighth of an inch) until the pointer turns into a four-headed arrow. The pointer must be in the same patch as the cursor.
2. Click and drag the cursor to its new destination. Once you have grabbed a cursor, its cross-hairs extend horizontally and vertically to the edge of the waveform graphic pane.

NOTE — If you move the mouse left or right, the cursor tracks the waveform to which it was originally attached. If you move the cursor up or down, it attaches itself to the waveform above or below on the stack.

If a cursor is not displayed in the waveform area, grab the cursor by clicking the label of the cursor box. If the cursor is attached to a waveform that is not displayed, it remains in the original waveform until the cursor is moved into the waveform graphic pane. At that time it jumps from waveform to waveform as the mouse pointer moves from waveform to waveform.

Moving a Cursor by Moving its Cursor Box

To move a cursor by changing its X or Y values:

1. In a cursor's box, click in either the X value or the Y value field.
2. Change the value in the field, then press the **Enter** key.

The waveform is modified to have that value at the current cursor location, and the cursor is moved to the next data point.

The waveforms are redrawn if the new location is off screen. If the cursor for a cursor box is scrolled off the screen, entering a return in this box causes the screen to snap to that cursor position in the waveform. If the cursor is not assigned to a waveform, it is assigned to the top of stack waveform.

To move a cursor by dragging its cursor box:

Click and drag on the label of the cursor box.

Attaching a Cursor to a Waveform

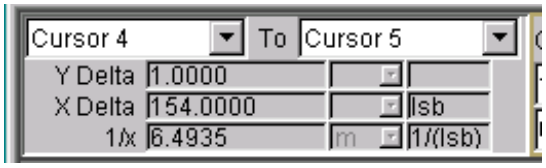
Cursors are normally attached to a waveform. When a cursor is moved from one waveform to another, the cursor now attaches to the new waveform.

If, however, you *pop* (remove the TOS waveform off of the stack) a waveform that a cursor is currently attached to, that cursor becomes unattached, its X and Y value fields become blank, and the cross-hair is removed from the screen. To reattach that cursor to a waveform, move to the label in the cursor box, press the left mouse button, drag down to the waveform that you want the cursor attached to, and release the button. The cross-hair and numbers in the X and Y value fields will reappear.

Understanding the Delta Information

Two delta boxes are located in the upper left corner of the Analog Wavetool window. See Figure 150.

Figure 150. Delta Boxes



To view the delta information about two cursors:

1. From the two cursor drop-down lists, choose the two cursors you wish to compare.
2. Use the guide below to interpret the readings.

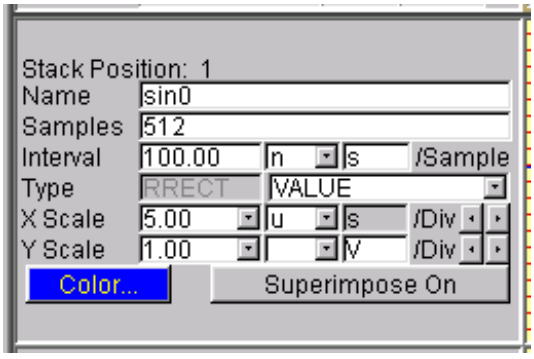
   Y Delta — Displays the difference in Y magnitudes of any two designated cursors.
   X Delta — Displays the difference in X values of any two designated cursors.
   1/X — Displays the difference in X values of two designated cursors in terms of 1/X. In other words, if the waveform is in the time domain, and the units are in seconds, this field displays Hertz (1/seconds).

NOTE — If two cursors are placed on top of one another, the Y Delta and X Delta values are 0.0 and the 1/X field displays "Infinite 1/(s)".
Also, if either the X or Y units are not the same, the delta boxes display the string incompatible units.

Name Pane

Each waveform displayed has an information pane located along the left edge of the waveform window, just below the delta information. Characteristics about the waveform are provided in the pane. An example is shown in Figure 151.

Figure 151. Name Pane



Following are descriptions of all fields and buttons located in the name pane area(s) of the Analog Wavetool windows.

Stack Position

Stack position displays the waveform's position on the stack of waveforms. Stack position 0 is the TOS (top-of-stack), stack position 1 is the next waveform, etc. This parameter cannot be directly edited -- it is updated after push, pop, create, and other operations which change the number of waveforms on the stack.

Name

This field displays the name of the waveform.

To edit the name of a waveform:

1. Delete the current contents of the **Name** field.
2. Enter the new name with an optional extension. (This becomes the new name of the waveform file.)

NOTE — If you enter an extension, the extension is kept; if you do not enter an extension, an appropriate extension is added for you. Leading and trailing spaces are removed, and all spaces within the name are converted to underscores.

3. Press the **Enter** key.

Samples

This field displays the number of samples in the waveform.

To change the number of samples in the waveform:

1. Delete the current contents of the **Samples** field.
2. Enter the number of samples
3. Press the **Enter** key.

At the Confirmation dialog, click **OK**. The Analog Wavetool then performs a cubic spline interpolation on the waveform to give the desired number of samples. This operation deletes the original waveform data.

Interval

There are three parts to the Interval field:

1. Value
2. Units Prefix

3. Units

Each of these variables pertains to the current sample (note the */Sample* designation at the end of the field).

Value

This field displays the sample interval of a time domain waveform. It is the bin weight of a frequency domain waveform. It can be any value.

To change the interval:

1. Delete the current content of the **Interval** field.
2. Enter a new value, then press the **Enter** key.

This does not actually change the waveform, but rather changes the header information that is used by the DSP functions.

There are two other parts to this field:

- Units Prefix
- Units

Units Prefix

This field works in conjunction with the Units field.

To specify a Prefix:

1. Click the drop-down menu in the middle of the **Interval** field.
2. Choose the desired prefix (n = nano-, m = milli-, etc.). This Prefix can also be selected by typing the appropriate letter when entering the interval value. A space represents a plain unit.

Units

This is an optional field that displays units for the distance between points in the X direction. Seconds are represented by *s*, and is the default entry here. This value can be set to any string; the string is used to determine what waveforms track the TOS waveform when the scale factor and position are changed.

To change the X units:

1. Delete the current content of the **Units** portion (third item) of the **Interval** field.
2. Enter a new value, then press the **Enter** key.

Changing this value for the TOS waveform automatically updates the **X Scale** units box as well.

Type

This is divided into sections. The first section cannot be edited and displays the waveform type: RRECT, CRECT or Polar. The second part provides a drop-down list for the selection of one of five components: VALUE, REAL, IMAG (imaginary), MAG (magnitude) and PHASE.

To choose a new component for a given waveform type:

1. Click the down arrow in the second part of the **Type** field.
2. Choose a component.
   Not all components are available for each waveform type:

   RRECT — Value is the only selection.
   CRECT — Choices are REAL and IMAG
   Polar — Choices are MAG and PHASE

The new component displays in the waveform patch to the right.

X Scale

X Scale field includes:

- Scale
- Units Prefix
- Units
- Zoom Up/Down

Each of these variables pertains to the current division (note the */Div* designation at the end of the field).

Scale

This is the relative scale of the X graticule marks. It can be changed to a preselected scale by using the drop-down list or any desired scale can be entered in directly.

Units Prefix

This field works in conjunction with the Units field.

To specify a time fraction:

1. Click the drop-down menu in the middle of the **X Scale** field.
2. Choose the Units Prefix (n = nano-, m = milli-, etc.).

Units

The units from the TOS Interval units box are included in scale display but cannot be modified here.

Zoom Up/Down

These buttons change the X scale factor up or down by one step (in a 1-2-5 sequence). If the displayed scale factor is 2.0, pressing the up button changes the scale factor to 5.0, and pressing the down button changes the scale factor to 1.0. If the displayed scale factor is manually set to 2.5, pressing the up button still changes the scale factor to 5.0, but pressing the down button changes the scale factor by the nearest step in the 1-2-5 sequence, and the result is 2.0.

Y Scale

There are four parts to the Y Scale field:

- Scale
- Units Prefix
- Units
- Zoom Up/Down

Scale

This field displays the relative scale of the Y graticule marks. It can be changed to a preselected scale by using the drop-down list or any desired scale can be entered in directly.

Units Prefix

This field works in conjunction with the *Units* field. To specify a fraction of the unit that follows, enter a prefix such as nano-, milli-, etc.

To specify a time fraction:

1. Click the drop-down menu in the middle of the **Y Scale** field.
2. Choose the Units Prefix (n = nano-, m = milli-, etc.).

Units

This optional field (to the right of the fractional measurement field) displays the units in the Y direction. To the right of this field is a string, /Div.

Zoom Up/Down

These buttons change the Y scale factor up or down by one step (in a 1-2-5-10 sequence). If the displayed scale factor is 2.0, pressing the up button changes the scale factor to 5.0, and pressing the down button changes the scale factor to 1.0. If the displayed scale factor is manually set to 2.5, pressing the up button still changes the scale factor to 5.0, but pressing the down button changes the scale factor by the nearest step in the 1-2-5 sequence, and the result is 2.0.

Color

The user can choose any color for a waveform.

To change the color of a waveform:

1. Click the color bar to the right of the **Color** label.
2. Use the color palettes and/or the color value tab to create a waveform color.
3. Click **OK**.

Superimpose On/Off

Superimposition displays a copy of a waveform patch onto the TOS waveform. This is useful for evaluating differences between waveforms. Several waveforms can be superimposed simultaneously.

To turn the superimpose feature on/off:

1. In the name pane section for the waveform you wish to affect, click the **Superimpose On** button.

The waveform is superimposed upon the TOS waveform and the button reverts to read *Superimpose Off*. The scale and scroll values that are used to display this waveform in its own waveform patch are used to display it superimposed on the TOS waveform.

Any modifications to a superimposed waveform are reflected in the TOS waveform patch. Any markers that are enabled display their graphical representation in the TOS patch, but no text is printed. All marker text applies only to the patch in which it appears.

2. To turn the superimpose feature off, click the **Superimpose Off** button.

The button returns to its original form and superimposition is removed.

Clear Superimpose

Clicking this button clears all superimposed waveforms, even those that have scrolled off the display.

Navigating the Waveform Graphic Pane

Waveforms are displayed in the waveform graphic pane section of the Analog Wavetool window (see Figure 139). This display is divided into waveform panes, each displaying one waveform. Other options, selected by way of the **View** menu, are reflected here as well.

Aside from cursors, which can be used to modify waveforms, there are two primary ways to navigate around the graphic pane:

- Zooming
- Scrolling

Zooming

Zoom in on a region of a waveform patch using the custom zoom capability.

To define an area on which to zoom:

1. Choose the menu item **View** > **Custom Zoom**... or... click the **Custom Zoom** icon (magnifying glass), or click in the center and drag to select a region.
2. Click and drag diagonally to specify the area to zoom.
3. Release the mouse button. The X and Y positions and scale factors are updated to cause the selected region to fill the patch.

To return to the default state of the patch waveform (unzoomed):

Choose the menu item **Edit** > **Undo Custom Zoom**.

Scrolling

Scroll a waveform along both axes:

- Scrolling Along the Y Axis
- Scrolling Along the X Axis

Scrolling Along the Y Axis

If a waveform extends vertically beyond the edges of the graphic pane or there are more waveforms that are fully displayed in the graphic pane, vertical scroll bars appears to the right of the waveform(s).

NOTE — If there are more waveforms than fit on the graphic pane, an additional vertical scroll bar that spans all of the patches appears. However, this scroll bar has no scroll menu.

To scroll a waveform along its Y axis (vertically):

Click and drag the scroll box up and down.

...or...

Click above or below the scroll box (fastest method).

...or...

Click the up and down arrow buttons at the ends of the scroll bar.

To scroll a waveform along its Y axis using menu options:

1. Right-click in one of the vertical scroll bars.
2. Choose one of the nine options below to position the waveform as desired:

   Scroll Here — Scrolls according to where you click on the scroll bar.

   Location — Scrolls to the Y axis point you specify. Enter a value and click **OK**.

   Top — Displays the top of the waveform.

   Center — Displays the vertical center of the waveform.

   Bottom — Displays the bottom of the waveform.

   Page Up — Scrolls up the waveform using the *height* of the patch as the scroll increment.

   Page Down — Scrolls up the waveform using the *height* of the patch as the scroll increment.

   Scroll Up — Scrolls up the waveform in very small increments.

   Scroll Down — Scrolls down the waveform in very small increments.

Scrolling Along the X Axis

If any of the displayed waveforms extend horizontally beyond the edges of the graphic pane, a horizontal scroll bar appears along the bottom of the pane.

This X scroll bar applies to the TOS waveform and all other waveforms on the stack that have the *same* X units. This means that waveforms having fractional measurement designations will not scroll along with those that display in whole units.

To scroll waveforms along their X axes:

Click and drag the scroll box left and right.

...or...

Click to the left or right of the scroll box (fastest method).

...or...

Click the left and right arrow buttons at the ends of the scroll bar.

To scroll waveforms along their X axes using menu options:

1. Right-click the horizontal scroll bar.
2. Choose one of the nine options below to position the waveform as desired:

Scroll Here — Scrolls according to where you click on the scroll bar.

Location — Scrolls to the X axis point you specify. Enter a value and click **OK**.

Left — Displays the far left of the waveform.

Center — Displays the horizontal center of the waveform.

Right — Displays the far right of the waveform.

Page Left — Scrolls left on the waveform(s) in *page-like* increments.

Page Right — Scrolls right on the waveform(s) in *page-like* increments.

Scroll Left — Scrolls left on the waveform(s) in very small increments.

Scroll Right — Scrolls right on the waveform(s) in very small increments.

To fit a waveform to its patch:

1. Right-click in the patch that contains the waveform to be rescaled.
2. Choose the menu item **Fit to Window**.

NOTE — Waveforms with the same units as the one being rescaled are also rescaled.

Annotating Waveforms (Markers)

Markers consist of four parts:

- Type
- Location
- Label
- Data

Type

A string that specifies the type of the marker. Several markers of the same type can be defined at different locations. Each instance of a particular marker type has its own location, label, and data.

Location

The X and Y coordinates define the location of the marker with respect to the waveform. These coordinates are in the same units as the waveform. If the waveform-data X units is seconds, the marker X coordinate is in seconds. If the waveform Y units is volts, the marker Y units is volts.

In the Waveform tool, markers are sorted by X coordinate. If two or more markers have the same X coordinate, they are in the order they were defined.

Label

A label is a string that contains information about the specific marker. In many cases, the label contains all the necessary information for a marker. In other cases, the label is used to specify variations on a marker type.

Data

Data can represent any number of integers, doubles, or strings. Each data item is defined as a label / value pair; a string that labels the value and the actual data value. In general, the number, labels, and types of data items are the same for all markers of the same type.

Markers are transferred from the tester to the Waveform tool, and read from and written to `.awav` files. The only way to define or modify markers is to edit a `.awav` file by editing the markers according to the syntax described in the Marker Syntax section.

While no constraints are placed on markers, the Waveform tool recognizes some specific marker types and displays them in a predefined way. Markers that are not recognized by the Waveform tool are drawn as generic markers.

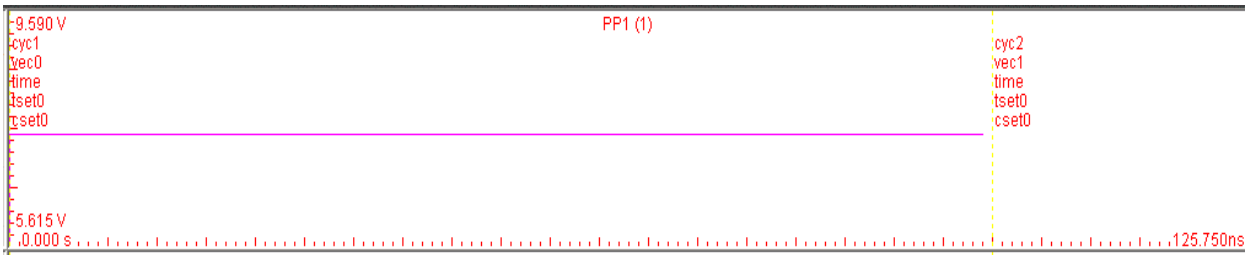
Marker Types

There are several types of markers:

- Title Marker
- Cycle Marker
- Cycle Count Marker
- Vector Marker
- Scan Marker
- Elapsed Time Marker
- Cycle Set Marker
- Time Set Marker
- Compare Marker
- Results Marker
- Generic Marker Pulse

- Generic Marker

Figure 152. Markers



To control which markers display and which do not:

1. Choose the menu item **View** > **Markers**.
2. A checkbox list of all marker types that currently exist are shown in the Marker Display Selection dialog. Select and/or deselect marker type checkboxes based on what to display in the waveform graphic pane area.
3. Click **OK**.

Also refer to:

Marker Control in CMD Files

Marker Syntax In AWAV Files

Title Marker

The title text appears centered at the top of the waveform patch. The text is taken from the marker label. The title contains the pin name, if pin name was defined, and number of the pin that is digitized. Only one title is displayed. If more than one title marker is defined for a waveform, the first title marker found is printed. The X coordinate is used to order the title markers. If more than one title marker is defined at the same location, the order is determined by the order the markers were defined. The Y coordinate is not used.

Cycle Marker

A cycle is shown by a dashed line from top to bottom of the patch at the location specified by the X coordinate. The Y coordinate is used to show which of the eight possible support modules provide the cycle timing. This value is used to select one of eight colors for the display of the cycle boundary (the eight colors are the grMarker1Color through grMarker8Color resources and can be redefined using the resource file).

Cycle Count Marker

The label text contains the cycle number of the displayed cycle. It is positioned near the top of the patch just to the right of the vertical line.

Vector Marker

The vector marker prints only text from the label field of the marker. It is positioned at the marker X coordinate with other cycle related text. The Y coordinate is not used. The label contains the number of the vector for the current cycle.

Scan Marker

The scan marker prints text only. It is positioned at the marker X coordinate with other cycle related text. The Y coordinate is not used. The label contains the scan partition and link for the current cycle. Any given cycle has either a vector or scan, never both.

Elapsed Time Marker

The elapsed time marker prints text only. It is positioned at the marker X coordinate with other cycle related text. The Y coordinate contains the elapsed time value. This is done so that the Waveform tool can format the data appropriately (using engineering notation) and add the X units from the waveform data structure. The text displayed consists of the marker label followed by the formatted elapsed time value and the appropriate units.

Cycle Set Marker

The cycle set marker prints text only. It is positioned at the marker X coordinate with other cycle related text. The Y coordinate contains the cycle set used for the current cycle. This information is also contained in the label so the Waveform tool does not use the Y coordinate.

Time Set Marker

The time set marker prints only text. It is positioned at the marker X coordinate with other cycle related text. The Y coordinate contains the time set used for the current cycle. This information is also contained in the label so the Waveform tool does not use the Y coordinate.

Compare Marker

The Analog Wavetool groups the following three marker types together under the label, Compare:

- Compare Edge
- Start Window Compare
- Stop Window Compare

Compare Edge Marker

The compare edge marker uses the label field to show the type of edge compare: high, low, or tristate. The marker is located at the marker X coordinate. The Y coordinate shows the comparator threshold. In the case of a tristate compare, an additional data item of type double is for the marker. The label for this data item is high and the data is the comparators high threshold level.

If the marker label is low, a vertical line is drawn from the top of the patch to the compare threshold (Y coordinate). If the marker label is high, a vertical line is drawn from the bottom of the patch to the comparator threshold. If the marker label is tristate, a vertical line is drawn from the top of the patch to the high compare threshold (Y coordinate) and a vertical line is drawn from the bottom of the patch to the low compare threshold (data item labeled high). The compare lines are drawn in the same color as the waveform.

Start Window Compare Marker

The start window compare and stop window compare markers define a window comparison. It is assumed that a start window compare precedes each stop window compare although other markers can be defined between the two. The X coordinate shows the start time of the window compare, the Y value shows the comparator threshold. The label is used to specify the type of comparison, low, high, or tristate. The start window compare marker does not cause anything to be drawn but the data is stored until the companion stop window compare is found.

Stop Window Compare Marker

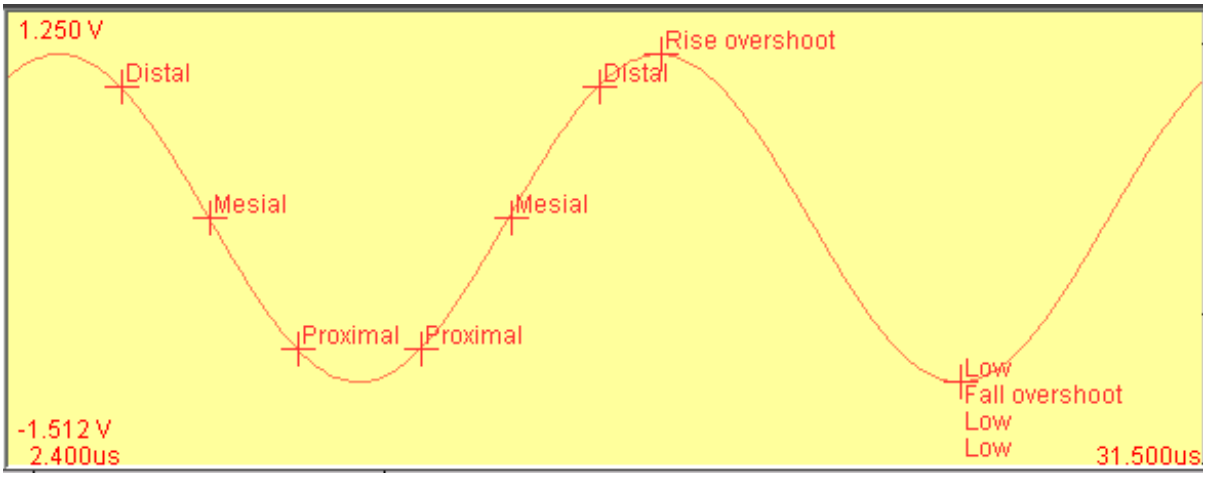
The stop window compare uses the data gathered from the start window compare to draw the window comparison indication in the waveform patch. The X coordinate is the stop compare time. The Y coordinate is used only when the comparison type is tristate, when it contains the comparator high threshold (the start window compare Y coordinate contains the low threshold). The label is unused.

If the comparison type is low, a rectangular box is drawn from the top of the patch down to the low threshold (start compare Y coordinate) between the start and stop times (start window compare X coordinate and stop window compare X coordinate). If the comparison type is high, the box is drawn from the bottom of the patch up. If the type is tristate, both low and high boxes are drawn. The color of the compare box is the same as the waveform.

Results Marker

Results markers are generated by the Waveform tool when results marking is enabled and a pulse measurement function is performed on the top of stack waveform. The X and Y coordinates determine *where* the marker is drawn, the label indicates *how* the marker indication is to be labeled. All results markers are drawn as a cross-hair with the label printed to the right of the cross-hair vertical and just above or below the cross-hair horizontal line. When you modify waveform data, results markers are updated.

Figure 153. Pulse Measurement Result Markers



All result markers defined in the pulse parameter pop-up, shown in figure Figure 153, are listed in Table 15.

Table 15. Result Markers

High	The high value of the pulse as computed for pulse *amplitude*.
Low	The low value of the pulse as computed for pulse *amplitude*.
Proximal	The proximal point of a *rising or falling edge*.
Mesial	The mesial point of a *rising or falling edge*.

Table 15. Result Markers *(Cont.)*

Distal	The distal point of a *rising or falling* edge.
Rise Overshoot or Fall Preshoot	The peak value in a pulse after a rising edge. If the peak occurs in the first half of the pulse, it is assumed to be overshoot from the preceding rising edge. If the peak occurs in the second half of the pulse, it is assumed to be preshoot from the following falling edge.
Fall Overshoot or Rise Preshoot	The peak value in a pulse after a falling edge. If the peak occurs in the first half of the pulse, it is assumed to be overshoot from the preceding falling edge. If the peak occurs in the second half of the pulse, it is assumed to be preshoot from the following rising edge.

Note Marker

A note marker is displayed in the same manner as a results marker, with a cross-hair at the location specified by the X and Y coordinates and the label printed near the cross-hair. In general, notes include a multiline string that describes why that point is of interest. Note you must hand edit the ASCII AWAV file to add these markers.

Generic Marker

Any marker type not described above is considered to be a generic marker. These markers are drawn as a diamond shape with a dot in the center of the diamond at the location of the X and Y coordinates. The label is printed to the right of the diamond marker. Note you must hand edit the ASCII AWAV file to add data for these markers.

Marker Control in CMD Files

As an alternative to turning marker display on/off using the menu system, use the display marker command in a command file. Command files have one of two file extensions: *.cmd* or *.aws*.

To turn marker display on/off using the command file:

1. Open a command file.
2. Using the syntax shown below, enter one or a series of commands that control the marker display.

   The syntax is...

   display marker <type> '=' [on | off] ';'
   ...where <type> is a string for the marker type.

3. Save the command file.

NOTE — If these commands are included in the initialization file, *awtinit.cmd*, the marker display is set up automatically when the Waveform tool is launched.

Example: The following series of commands turn on the display of title, cycle, vector and compare markers and turns off the display of the others:

```
display marker "Title" = on;
display marker "Cycle" = on;
display marker "Vector" = on;
display marker "Scan" = off;
display marker "Elapsed Time" = off;
display marker "Cycle Set" = off;
display marker "Time Set" = off;
display marker "Compare" = on;
display marker "Results" = off;
display marker "Note" = off;
```

Marker Syntax In AWAV Files

Marker data is stored in AWAV files. Currently, the only way to edit or delete markers is by editing the AWAV file generated when a waveform with markers is saved using the **Save As** menu item.

The syntax for markers in the AWAV file is as follows:

```
MSTMT: 'marker' TYPE LABEL '=' X_COORD ',' Y_COORD [ ';' | BLOCK ]
BLOCK: '{' DSTMT [ ',' DSTMT ... ] '}'
DSTMT: LABEL '=' [ INTEGER | DOUBLE | TEXT ] ';'
TEXT: STRING [ ',' STRING ... ]
TYPE: STRING
LABEL: STRING
X_COORD: DOUBLE
Y_COORD: DOUBLE
```

Where:

`STRING` is a quoted string.
`DOUBLE` is a double precision number (floating point format).
`INTEGER` is an integer (fixed point format).
`[ P | Q ]` denotes a choice between P or Q
`...` denotes repetition
`'xyz'` denotes a literal

A marker statement of type, type1, having the label, label1, with X and Y coordinate values of 1.0 and 2.0 respectively and having no additional data appears as follows in the AWAV file:

```
marker "type1" "label1" = 1.0, 2.0 ;
```

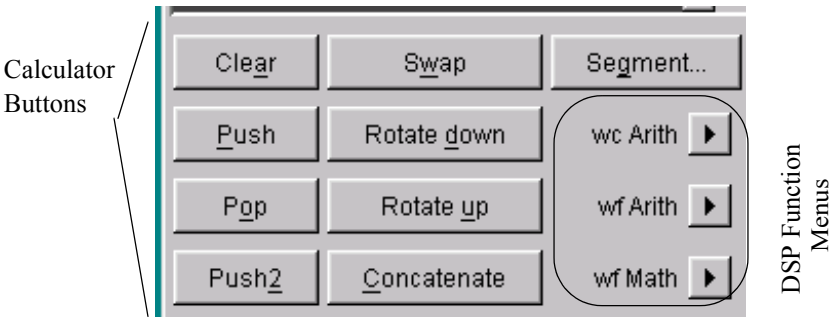
A marker statement similar to the above with an integer data value labeled `labelInt`, a double data value labeled `labelDbl`, a single line text data value labeled `labelText1` and a multi-line text value labeled `labelText2` appears as follows in the AWAV file:

```
marker "type2" "label2" = 3.0, 4.0 {
  "labelInt" = 5 ;
  "labelDbl" = 6.0 ;
  "labelText1" = "One line text" ;
  "labelText2" = "First line of multi line",
    "Second line of multi line",
    "Third line of multi line" ;
}
```

Using the Display Buttons

The rectangular area in the lower left corner of the Analog Wavetool window is sometimes collectively referred to as *the calculator area*. The display buttons are the nine push buttons that make up the left half of this area. The other buttons are DSP function menus.

Figure 154. Display Buttons of the Calculator Area



All operations and measurements (with the exception of the Segment function) are performed across the entire waveform on a data point by data point basis. For binary operations such as add or multiply, the sample interval is ignored and the data points of the two waveforms are combined based upon the selected operation. The resulting waveform has the same sample interval and number of points as the TOS waveform before the operation.

The display buttons are described in the following section.

Clear

Clicking this button removes all waveforms from the stack.

Push

Clicking this button pushes a copy of the TOS waveform onto the stack.

Pop

Clicking this button removes the TOS waveform off of the stack.

Push2

Clicking this button pushes two waveforms (TOS and next to TOS) onto the stack together. This is quite useful when both components of a complex or polar waveform are on the stack.

Swap

Clicking this button exchanges the TOS and the next to TOS waveforms.

Rotate Down

Clicking this button rotates the stack down one. This causes the element on the top of the stack to be placed on the bottom of the stack and the next to TOS becomes the TOS.

Rotate Up

Clicking this button rotates the stack up one. This causes the element on the bottom of the stack to be placed on the top of the stack.

Concatenate

Clicking this button takes the TOS waveform and concatenates it at the end of the next to TOS waveform producing a single waveform with a length that is the sum of the lengths of the two original waveforms.

Segment

Clicking this button creates a new waveform based on a segment specified on the current TOS waveform. If one or more cursors exist, there are three ways to designate the values. The segment between any of the following can be designated:

- Two cursors (unless there is only one cursor).
- One cursor and one axis value.
- Two axis values.

To specify a waveform segment:

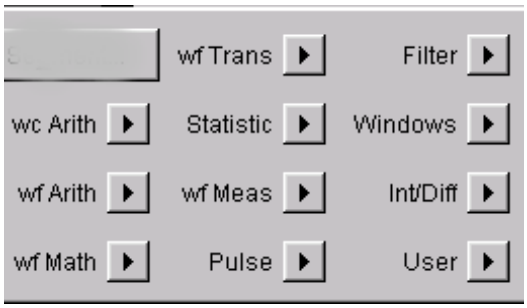
1. Click the **Segment** calculator button.
2. Using the two columns, define the segment that is to be the new waveform.
3. Click **OK**.

   The new waveform appears in the TOS position. The original waveform remains unchanged and next to TOS.

Using the DSP Function Menus

The rectangular area in the lower left corner of the Analog Wavetool is sometimes collectively referred to as the *calculator area*. The DSP functions menu section comprises 11 buttons, as shown in Figure 155, that make up the right half of this area. The other buttons are the display buttons.

Figure 155. DSP Functions



The (▸) symbol on these buttons indicates that each has a pop-up menu. To see the menu, click the button. The following sections describe menu options for each button.

All operations and measurements (with the exception of the Segment function) are performed across the entire waveform on a data point by data point basis. For binary operations such as add or multiply, the sample interval is ignored and the data points of the two waveforms are combined based upon the selected operation. The resultant waveform has the same sample interval and number of points as the TOS waveform before the operation.

Wc Arith Functions

Wc Arith menu items and a description of each function are shown in Table 16.

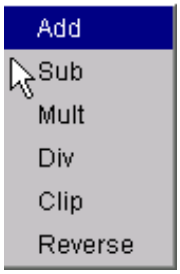
Table 16. WC Arith Function Descriptions

Menu Item	Function
Add Const	Adds a constant to the TOS waveform.
Sub Const	Subtracts a constant from the TOS waveform.
Mult Const	Multiplies the TOS waveform by a constant.
Div Wf/Const	Divides the TOS waveform by a constant.
Div Const/Wf	Divides a constant by the TOS waveform. This can be used to invert the waveform (1.0/Wf).
Clip Const	Clips the TOS waveform to a constant, that is, does not allow the magnitude of the waveform to go above the constant value.
Clip Bipolar	Clips the TOS waveform to upper and lower constants, that is, does not allow the magnitude of the waveform to go above the upper constant or below the lower constant.
Shift Const	Shifts the numeric value of each point in the TOS waveform left or right by some number of bits, with zero fill, and replaces the TOS waveform with the result.
Boolean	Performs a logical AND, OR, or XOR of the mask with the numeric value of each point in the TOS waveform and replaces the TOS waveform with the result.
X Offset	Sets the X offset time for the TOS waveform. Note that the X offset is in terms of waveform and sample interval (user units). Performing this operation may move the waveform out of the field of view.
Norm	Normalizes the TOS waveform to be between 0 and 1.
Abs	Takes the absolute value of the TOS waveform. That is, it makes all negative values positive, and leaves all positive and zero values unchanged.

Wf Arith Functions

Wf Arith menu items and a description of each function are shown in Table 17.

Table 17. Wf Arith Function Descriptions



Menu Item	Function
Add	Adds the magnitudes of the TOS and next TOS waveforms together. Places the result on TOS. Original waveforms are deleted.
Sub	Subtracts the magnitude of the TOS from the magnitude of the next TOS waveform. Places the result on TOS. Original waveforms are deleted.
Mult	Multiplies the magnitudes of the TOS and next TOS waveforms together. Places the result on TOS. Original waveforms are deleted.
Div	Divides the magnitude of the TOS by the magnitude of the next to TOS waveform. Places the result on TOS. Original waveforms are deleted.
Clip	Clips the TOS waveform by the next to TOS waveform; that is, does not let the magnitude of the waveform go above the value in the next to TOS waveform. The TOS waveform is replaced but the next to TOS waveform is left unchanged.
Reverse	Reverses the indexes of the TOS waveform; that is, the first index now equals the last index and the last index equals the first index. Another way to do this is to rotate the waveform around the Y axis.

Wf Math Functions

Wf Math menu items and a description of each function are shown in Table 18.

Table 18. Wf Math Function Descriptions

Menu Item	Function
Polar	Performs a Polar conversion of a CRECT waveform; that is, converts Sine and Cosine (vector) components of a CRECT waveform into MAGnitude and PHASE (POLAR).
Rectang	Performs a Rectangular (CRECT) conversion of a POLAR waveform; that is, converts the MAGnitude and PHASE components of the POLAR to Sine and Cosine (vector) components.
Log	Takes the log (any base) of the TOS waveform.

Table 18. Wf Math Function Descriptions *(Cont.)*

Menu Item	Function
Power (base^ wf)	Takes the BASE^X of the TOS waveform. Base defaults to 10. Note that this is the inverse of the log function.
Power (wf ^ exp)	Raises the TOS waveform to a power.
Sqrt	Takes the Square Root of the TOS waveform.
Histogram	Creates a histogram of the TOS waveform. The waveform must be scaled such that its minimum is greater than or equal to zero (0) and its maximum is less than or equal to the size of the histogram waveform. Thus, if the size of the histogram waveform is 256, the original waveform should contain values between 0.0 and 255.0.
Average	Averages the TOS waveform. The number of averages is used to determine the size of the resulting averaged waveform. If the length of the original waveform is 1024 and the number of averages is specified as four, the resulting averaged waveform has a length of 256. In this case, elements 0, 256, 512, and 768 would be added and divided by 4 to produce element 0 of the resulting waveform.
Interleave	Interleaves one or more source waveforms into one destination waveform.
Deinterleave	Deinterleaves a source waveform into one or more destination waveforms.
Encode	Converts data from a decoded RLONG or RRECT waveform to an encoded RLONG waveform, which is then placed on TOS. The operation transforms N bits of each waveform point using the specified data encoding.
Decode	Decodes the TOS waveform according to the specified number of bits and the specified code format. When the SWAV format is specified in the Save As dialog, the code formats are listed in a drop-down menu. Selecting NATURAL_BINARY causes no change in the data. When selecting a-law, u-law, or BCD, the number of bits parameter is not used.

Table 18. Wf Math Function Descriptions *(Cont.)*

Menu Item	Function
Mux	Multiplexes data from the TOS waveform data that gets replaced by the result. Some A-D converters store an output signal in two or more output words; for example, storing a 16-bit signal in two 8-bit words. The unpacked information must be multiplexed in order to process the signal properly. The number of bits used per sample means the number of valid bits per data word. In other words, out of 32 bits per word of data, how many are valid? Mux Factor is the number of input data samples to be multiplexed into each sample of the output waveform. The operation takes M bits (Bits per Sample) from each N successive points (Nbr of Samples) in the TOS waveform and multiplexes them together into a single point in the resultant waveform. The number of points in the resulting waveform is the original number divided by Nbr of Samples. **Note**: Mux and Demux are *not* the inverse of one another.
Demux	Demultiplexes data from the TOS waveform data, pushing the resulting waveform(s) on top of stack. The operation extracts up to four waveforms from the TOS waveform. Each non-zero mask is applied to each value in the TOS waveform to yield another waveform that is then pushed onto the stack. The waveform for mask 1 is pushed onto the stack first, followed by waveforms for mask 2, 3, and 4, if specified. **Note**: Mux and Demux are *not* the inverse of one another.
Reorder	Reorders the samples of the TOS waveform, thus changing the number of repetitive cycles displayed and making the details of each cycle more or less visible.

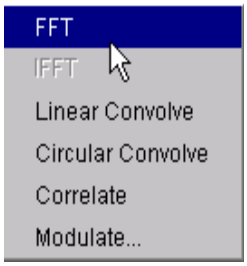
Table 18. Wf Math Function Descriptions *(Cont.)*

Menu Item	Function
Split	Splits a CRECT or Polar waveform into two RRECT waveforms.
POLAR Splice	Splices two RRECT waveforms into a single Polar waveform.
CRECT Splice	Splices two RRECT waveforms into a single CRECT waveform.

wf Trans Functions

Wf Trans functions are used in Waveform transformations between time domain and frequency domain; convolution and correlation. Wf Trans menu items and a description of each function are shown in Table 19.

Table 19. Wf Trans Function Descriptions



Menu Item	Function
FFT	Takes the FFT of the TOS waveform.
IFFT	Takes the Inverse FFT of the TOS waveform. **Note:** The waveform must be of type CRECT.
Linear Convolve	Performs a linear convolution of the TOS with the next to TOS waveform.
Circular Convolve	Performs a circular convolution of the TOS with the next to TOS waveform.
Correlate	Correlates the TOS with next to TOS.
Modulate	Takes the TOS waveform as a carrier and the next-to TOS waveform as a modulator and pushes the result of modulating the carrier by the modulator onto the stack. Both waveforms must be of type RRECT. Selecting *Modulate...* invokes the *Phase and Modulate* window that requires choosing **Modulation type** (Frequency or Phase) and input the **output waveform sample interval**. The defaults are frequency modulation and a 1.0-ns sample interval. When modulation is performed, both carrier and modulator are linearly interpolated and the result used to modulate the carrier either by frequency or phase, depending on the selection made. The resulting waveform is pushed onto the stack.

Statistic Functions

The Statistic functions are DSP measurement functions that return numerical results (minimum, maximum, standard deviation, etc.). They do not alter any waveforms. Statistic menu items and a description of each function are shown in Table 20.

Table 20. Statistic Function Descriptions

Menu Item	Function
MinMax Wf	Finds the minimum and maximum values in the TOS waveform and their respective locations. The results are written in the transcript pane.
MinMax Segment	Finds the minimum and maximum values in the TOS waveform between two points -- cursors or axis points -- and writes the results in the transcript pane section of the Analog Wavetool window.
MeanStd	Calculates the following statistics on the TOS waveform and writes the results in the transcript pane: Mean, Standard Deviation, Variance, and Root Mean Square (RMS).
Median	Finds the median of the TOS waveform and writes the results in the transcript pane.

wf Meas Functions

The Wf Meas functions are DSP measurement functions that return numerical results (SNR, INL etc.); they do not alter any waveforms.

Wf Meas menu items and a description of each function are shown in Table 21.

Table 21. Wf Meas Function Descriptions

Menu Item	Function
Ratios	This operation extracts the following functions from the TOS waveform: RMS noise, signal to noise ratio, signal to distortion ratio, signal to noise and distortion ratio, magnitude of fundamental, and DC offset. The user is prompted for the following parameters when choosing this option: - Number of harmonics Negative one (−1) is the default that tags all non-aliased harmonics to be included in the total harmonic content (SDR) calculation. This parameter allows for the inclusion of aliased harmonics in the SDR calculation that implies that they are not included in the SNR calculation. The following results are written in the transcript pane: - RMS noise in dB - Signal to noise ratio (SNR) in dB - Signal to distortion ratio (SDR) in dB - Signal to noise & distortion ratio (SNDR) in dB - Magnitude of fundamental - DC offset

Table 21. Wf Meas Function Descriptions *(Cont.)*

Menu Item	Function
Ratios(Filt)	This operation extracts the following functions from a filtered TOS waveform: - RMS noise - Signal to noise ratio - Signal to distortion ratio - Signal to noise and distortion ratio - Magnitude of fundamental - Fundamental bin - DC offset The user is prompted for the following parameters when choosing this option: - Fundamental bin - Number of harmonics Negative one (−1) is the default that tags all non-aliased harmonics to be included in the total harmonic content (SDR) calculation. This parameter allows for the inclusion of aliased harmonics in the SDR calculation that implies that they are not included in the SNR calculation. The following results are written in the transcript pane: - RMS noise in dB - Signal to noise ratio (SNR) in dB - Signal to distortion ratio (SDR) in dB - Signal to noise & distortion ratio (SNDR) in dB - Magnitude of fundamental - DC offset
EffBits	This operation performs an effective bits measurement on the TOS waveform. It takes the sine curve fit of the waveform and compares the pure sine wave it calculated to the original waveform to get the resulting figure of merit. The user is prompted for the following parameters when choosing this option: - ADC full scale - Frequency convergence - Phase convergence The following results are written in the transcript pane: - Effective bits

Table 21. Wf Meas Function Descriptions *(Cont.)*

Menu Item	Function
INL/DNL (Ramp)	This operation measures the integral non-linearity (INL) and differential non-linearity (DNL) on a set of user-collected data. The data must be digitized from a linear ramp(s). This is allowed if the full scale range of the ADC is broken up into multiple segments, but the order of segments must start from the most full-scale ramp on TOS to the most zero-scale. The user is prompted for the following parameters when choosing this option: - Number of segments - Number of ADC bits - Number of ramps per segment (averaging) - Ramp magnitude - Vref of ADC (+ref to -ref) - Starting offset of AWG ramp The following results are written in the transcript pane: - DNL minimum error - DNL maximum error - INL minimum error - INL maximum error - Offset error - Gain error In addition, the following waveforms are created and placed on the TOS: DNL waveform, INL waveform. The original waveforms are simply pushed farther onto the stack, but are otherwise unaltered.

Table 21. Wf Meas Function Descriptions *(Cont.)*

Menu Item	Function
INL/DNL (Sine)	This operation measures the integral non-linearity (INL) and differential non-linearity (DNL) on a histogram of user-captured data. The data must be digitized from a sine wave. The user is prompted for the following parameters: - ADC full scale - Sine wave amplitude - Missing codes threshold The following results are written in the transcript pane: - DNL maximum error - DNL minimum error - INL maximum error - INL minimum error - Offset error - Full scale error - Number of missing codes In addition, the following waveforms are created and placed on the TOS: DNL waveform, INL waveform. The original waveforms are simply pushed farther onto the stack, but are otherwise unaltered.
IntermodDist	This operation performs an intermodulation distortion measurement of the TOS waveform. The user is prompted for the following parameters: - First frequency bin - Second frequency bin The following results are written in the transcript pane: - Intermodular distortion

Table 21. Wf Meas Function Descriptions *(Cont.)*

Menu Item	Function
SineCurveFit	This operation performs a sine-curve-fit of the TOS waveform. It uses a polynomial cubic spline approach to define the best-fit sine wave to the TOS waveform. The user is prompted for the following parameters: - Frequency convergence - Phase convergence - Starting frequency The following results are written in the transcript pane: - Amplitude - Offset - Frequency - Phase - Number of cycles
Group Delay	This operation takes the two TOS waveforms and calculates the group delay and frequency response waveforms. The TOS waveform is assumed to be the output of the DUT while the next-to-TOS waveform is assumed to be the input waveform to the DUT. Both input/output waveforms must contain a single edge, not a pulse. The user is prompted for the following parameters: - Bandwidth limit (enter 0.0 for no limit) - Filter type (Low Pass, High Pass, Band Pass, or Band Stop) When this function is performed, the group delay waveform is pushed onto the stack followed by the frequency response waveform. The following results are written in the transcript pane: - Frequency response In addition, the following markers are added to the waveforms: - Low Pass Filter Frequency Response in Hz (the –3dB point of the frequency response waveform). - Group Delay (peak to peak, maximum and minimum of group delay waveform before the 3dB point). - High Pass Filter Frequency Response in Hz (the point 3dB down from the last data point in the frequency response waveform).

Table 21. Wf Meas Function Descriptions *(Cont.)*

Menu Item	Function
Group Delay (Continued)	- Band Pass Filter Center Frequency (maximum of the frequency response waveform). - Band Stop Filter Center Frequency (minimum of the frequency response waveform). **Note:** The center frequency for band pass and band stop filters can be misleading if the bandwidth limit is not set for these filter types.

Pulse Functions

This pop-up menu offers several sets of functions that can be measured. In all cases except settling time, quadratic interpolation is used to increase the accuracy of the measurements.

To select the pulse (for all but settling time):

1. Place one cursor before the first edge of the pulse.
2. Place another cursor after the last edge of the pulse.

   The region between the cursors is used for the pulse measurements. If this region contains two edges between the cursors, the Period / Pulse Width function returns just the pulse width. If three or more edges are in the region, the period and duty factor (based on the first three edges) are returned.

To select the pulse for settling time:

1. Place the first cursor at the location from which the settling time is to be measured.
2. Place the second cursor in a region of the pulse that is settled (usually near the end of the pulse). No interpolation is done by the settling time function.

Pulse menu items and a description of each function are shown in Table 22.

Table 22. Pulse Function Descriptions

Menu Item	Function
All	This function measures and displays all pulse functions except for settling time.
Amplitude	This function displays the following: - Pulse high level - Pulse low level - Amplitude (high - low) These values are determined by creating a histogram of the data values between the cursors, finding the two most populated bins of the histogram, then using either the mode or the mean of all data values to determine the final high and low values. **Note**: If the pulse being measured is very small and somewhat noisy, the function may not be able to discern two discrete levels. After clicking the **Amplitude**, the user is prompted for the following parameters: - *Range* (the voltage size of one bin in the level detection histogram) - *Level Algorithm* (Mode or Mean)
Rising Edge	This function measures the falling edge. The fall interval (fall time if the X axis is in time units) and the location of the proximal, mesial, and distal points of the falling transition are printed. The user is prompted for the following parameters: - Proximal percent (default 100%) - Distal percent (default 90%) - Range (size of one bin in the level detection histogram)
Falling Edge	- Level Algorithm (Mode or Mean) - Cross Count (number of points above/below a level for a valid cross)

Table 22. Pulse Function Descriptions *(Cont.)*

Menu Item	Function
Period / Pulse Width	This function measures the period (if three edges are included in the region), or pulse width (if only two edges are included). The user is prompted for the following parameters: - Mesial percent (default 50%) - Range (the size of one bin in the level detection histogram) - Level Algorithm (Mode or Mean) - Cross Count (number of points above/below a level for a valid cross)
Rising / Falling Overshoot	This function measures the overshoot on the rising and falling edges of the pulse. The overshoot (as a percentage of the pulse amplitude) as well as the peak value and the location of the peak value are printed. The user is prompted for the following parameters: - Range (the size of one bin in the level detection histogram) - Level Algorithm (Mode or Mean) - This function gives a settling time (to the limits of the sample rate) for a rising or falling edge. One cursor is placed on the edge at the point from which the settling time is to be measured. The other cursor is placed near the end of the pulse, well after the signal has settled.

Table 22. Pulse Function Descriptions *(Cont.)*

Menu Item	Function
Settling Time	This function gives a settling time (to the limits of the sample rate) for a rising or falling edge. One cursor is placed on the edge at the point from which the settling time is to be measured. The other cursor is placed near the end of the pulse, well after the signal has settled. The user is prompted for the following parameters: - Stable Period (the amount of time the signal must remain within the range to be considered stable) - Level Averaging Period (amount of time before the second cursor location over which to average the signal to determine the stable value of the pulse) - Allowed Delta (the size of the range of values for which the signal can be considered settled) - The values at the first and second cursors of the waveform determine if the edge is a rising or falling edge. The first cursor value must be less than the second cursor value for rising edges and vice versa for falling edges. This function does no interpolation. It works directly with the data points from the waveform. Therefore, the results are always a multiple of the sample interval and may not be as accurate as with other pulse functions. **Note**: Settling times of zero print neither a result nor an error message. Zero settling times occur for perfect waveforms, such as those created by waveform creation routines.

Table 22. Pulse Function Descriptions *(Cont.)*

Menu Item	Function
Serial to Parallel	This function converts a serial pulse train into a series of parallel words. The TOS waveform is sampled at a specified rate (starting from a given offset). At each sample point, the waveform amplitude is compared to a specified threshold. If the waveform amplitude is above the threshold, the value is considered a logical high (1). If the waveform amplitude is below the threshold, it is considered a logical low (0). The user is prompted for the following parameters: - Resample start point - Resample rate and threshold - Number of bits in the resulting parallel word - Bit ordering (MSB First or LSB First) - Where the result is displayed (waveform, the transcript pane, or both)

Table 22. Pulse Function Descriptions *(Cont.)*

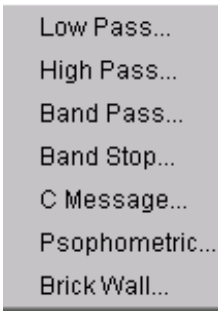
Menu Item	Function
Parallel to Serial	This function converts a waveform into a serial pulse train to create a bit stream for a serial DAC. Save the file as a *.swav*, and input that to the serial DAC. The TOS waveform is assumed to represent a series of parallel words, one word per data point. These words are converted into a series of pulses, based on the number of bits and bit order. At each data point, the waveform value is rounded to an integer and the resulting twos complement integer value determines the bit values to put in the output waveform. The user is prompted for the following parameters: - Number of bits per input value in the resulting serial bit stream - Bit ordering (MSB first or LSB first) If a data point from the input waveform has a value of 5, the number of bits set to 4, and the bit ordering to MSB first, the following four data points are put into the output waveform: 5 ⇒ 0101 A value of –3 for the input produces the following set of four output data points: –3 ⇒ 1101 Since in this case, only four bits are being looked at, the data values of –3, 13, –19 and 269 all produce the output sequence of 1101. The number of data values in the output waveform is the number of data values in the input waveform multiplied by the number of bits specified.

Filter Functions

Choosing one of the seven finite impulse response (FIR) filter causes a time domain waveform to be pushed onto the TOS. This waveform can be convolved with the next to TOS waveform (refer to wf Trans) to create a filtered version of the original.

Filter menu items and a description of each function are shown in Table 23.

Table 23. Filter Function Descriptions



Menu Item	Function
Low Pass	- Creates a low pass digital filter. The user is prompted for the following parameters: - Name - Sample Interval - Pass Frequency - Number of Samples
High Pass	Creates a high pass digital filter. The user is prompted for the following parameters: - Name - Sample Interval - Pass Frequency - Number of Samples
Band Pass	Creates a band pass digital filter. The user is prompted for the following parameters: - Name - Sample Interval - Start Frequency - Stop Frequency - Number of Samples
Band Stop	Creates a band stop (notch) digital filter. The user is prompted for the following parameters: - Name - Sample Interval - Start Frequency - Stop Frequency - Number of Samples

Table 23. Filter Function Descriptions *(Cont.)*

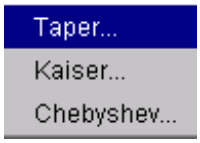
Menu Item	Function
C Message	Creates a C-message filter. A C-message filter is essentially a band-pass filter. These filters are used in testing telecom devices. The user is prompted for the following parameters: - Name - Sample Interval - Number of Samples
Psophometric	Creates a psophometric filter. A psophometric filter is essentially a band-pass filter. These filters are used in testing telecom devices. The user is prompted for the following parameters: - Name - Sample Interval - Number of Samples
Brick Wall	Creates a brick wall filter waveform. The user is prompted for the following parameters: - Name - Sample Interval - Start Frequency - Stop Frequency - Number of Samples

NOTE — To use the filter waveform in a convolve operation, the sample interval must match the sample interval of the waveform to be filtered.

Windows Functions

Windows operations enable users to apply various window functions to the TOS waveform. Window menu items and a description of each function are shown in Table 24.

Table 24. Windows Function Descriptions

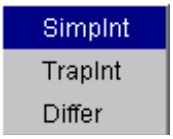


Menu Item	Function
Taper	Applies a taper windowing function to the TOS waveform.The user is prompted for the following parameters: - Windowing Function - Fraction (0.0 - 1.0) Window functions include: - Rectangular - Triangular - Hanning - Hamming - Blackman - Flattop
Kaiser	Applies a Kaiser window to the TOS waveform. The user is prompted for the following parameters: - Fraction (0.0 - 1.0) - Peak Approximate Error (in dB) of resulting waveform
Chebyshev	Applies a Chebyshev (filter) window to the TOS waveform. The user is prompted for the following parameters: - Fraction (0.0 - 1.0) - Normalized Transition Width - Ripple, Main Lobe to Side Lobe *Either* the ripple of the side lobes or the transition width must be set to a non-zero value. The other of these two parameters *must* be set to zero.

Int/Diff Functions

This option performs integration and differential (Int/Diff) functions. Note that after integrating a waveform, the area can be determined by subtracting the magnitudes of two X values. This is done by using the cursors. Int/Diff menu items and a description of each function are shown in Table 25.

Table 25. Int/Diff Function Descriptions



Menu Item	Function
SimpInt	Performs a Simpson integration on the TOS waveform.
TrapInt	Performs a Trapezoidal integration on the TOS waveform.
Differ	Performs a differentiation of the TOS waveform.

NOTE — For waveforms that have an even number of cycles, the Trapezoidal integration provides more accuracy.

User Functions

This menu begins with the **Shell** item (Shell prompt window, shown in Figure 156) and is followed by the filenames for any scripts that you have created.

Figure 156. Shell Dialog

To enter a shell command:

1. Choose the Calculator menu item **User > Shell**. (This is the same as choosing the menu item **Tools** > **Shell**).
2. Enter a shell command.
3. Click **OK**.

To invoke a script:

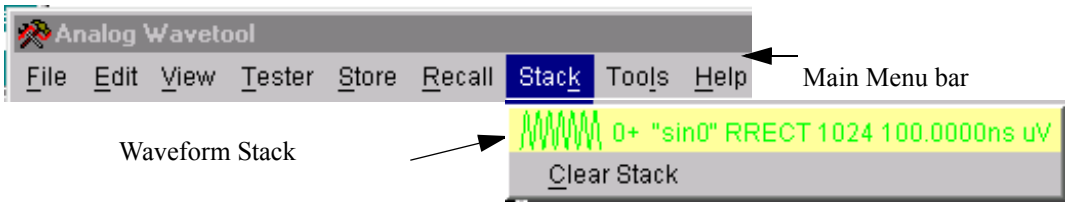
Choose the DSP menu item **User > <ScriptFilename>**, where **<ScriptFilename>** is any script that you have created. These can also be accessed by way of the Tools menu option.

By default, the **Documents and Settings\<username>** folder is checked. This can be changed at **Tools** > **Options** > **Default Locations**. If no appropriate file is found in this location, the button is left undefined.

Working with the Stack

The **Stack** menu item on the main menu bar (see Figure 157) displays the current state of the waveform stack with status information about each entry on the stack. This information is also displayed in the lower right corner of the Analog Wavetool. The data is printed in the same color as its corresponding waveform.

Figure 157. Stack Menu


Analog Wavetool
File Edit View Tester Store Recall Stack Tools Help
Main Menu bar
Waveform Stack
0+ "sin0" RRECT 1024 100.0000ns uV
Clear Stack

The stack index number shows the relative location in the stack of the waveform. The index of the top of stack waveform is zero, the next to top of stack waveform has an index of one, and so on. A “+” following the index indicates that at least one cursor is attached to the waveform. The letter “S” indicates that the waveform is superimposed on the TOS waveform. The waveform name is listed followed by the type. “R” is a real rectangular waveform, Cr and Ci are complex rectangular waveforms with the real or imaginary component displayed, Pm and Pp are a polar waveforms with magnitude or phase displayed. The number of points in the waveform is displayed next followed by the sample interval and vertical units.

For waveforms currently connected to a tester, additional information is displayed. The tester read mode is the current read mode: Read, Auto Update, or Retrace. The command file identifies the command file that is currently specified and enabled. If a command file is specified but not enabled, no command file is listed in the stack display.

To clear the stack:

Choose the menu item **Stack** > **Empty Stack**.
This removes all waveforms.

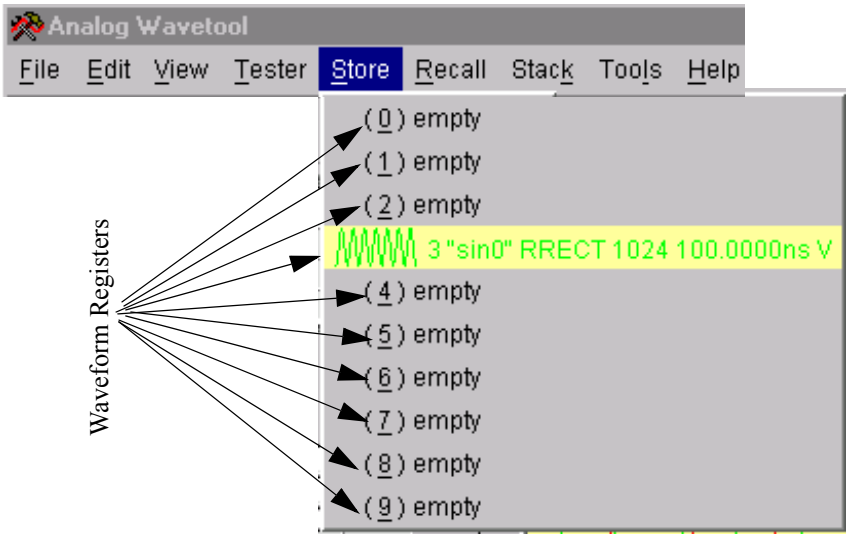
To move a different waveform to the TOS:

Select the desired waveform from the **Stack** menu.

Storing/Recalling a Waveform

The Analog Wavetool has 10 waveform registers (numbered 0 through 9), as shown in Figure 158.

Figure 158. Waveform Registers



To store the TOS waveform in a register:

1. Click the **Store** menu.
2. Choose any empty register.

The menu notation by the register you choose changes from *Empty* to the name of the stored waveform. The X and Y scale and position data is stored.

To recall a waveform from a register:

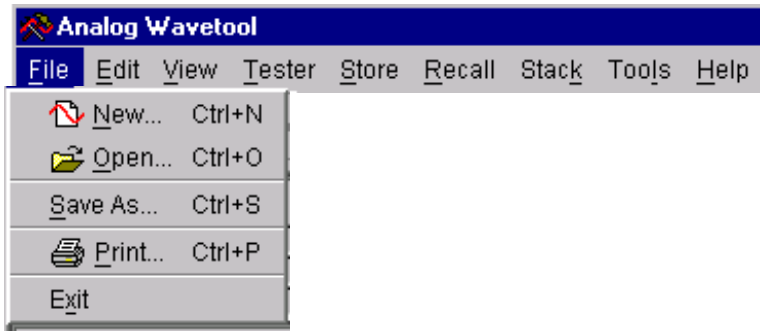
1. Click the **Recall** menu.
2. Click the register that contains the waveform you wish to recall.

The waveform automatically becomes TOS. The X and Y display values are restored.

Saving a Waveform

Saving a waveform writes the TOS waveform to disk in the specified file type. The file name is derived from the name specified in the Name field upon creating the waveform. The name can be changed in the Save As dialog.

Figure 159. File Menu



To save a waveform to disc:

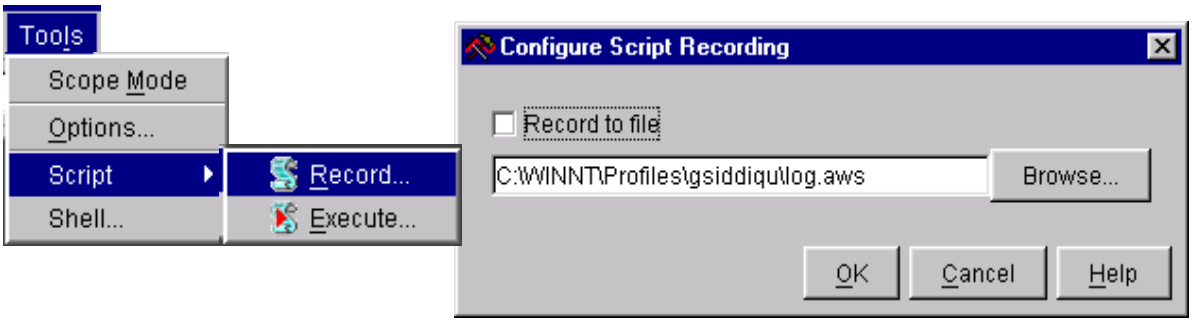
1. Choose the menu item **File** > **Save As** in the main menu bar.
2. Navigate to the directory to which you want to save the waveform.
3. Name your waveform file with the appropriate extension.
4. Click **OK**.

Creating and Executing Scripts

In addition to all the functions available, scripts that execute specific functions can be created with the display and DSP function buttons. These script files can have one of two extensions: *.aws* (default) or *.cmd*.

The dialog box for creating and executing a script is shown in Figure 160.

Figure 160. Creating a Script Dialog Box



To create a script:

1. Choose the menu item **Tools > Script > Record**.
2. Click the **Record to File** checkbox.

3. Enter the name of a new script file that does not currently exist.
   ...or...
   Enter or browse for the name of an existing script file to which commands can be appended. To browse for an existing script file, click the **Browse** button, navigate to the desired *.aws* or *.cmd* file, then click **OK**.
4. Click **OK**.
   All subsequent actions are recorded and written to the file specified in step 3.

NOTE — If the Record to File checkbox is already checked, you can click the Begin Script Recording icon on the toolbar to begin recording. To include comments to this file as well, choose the Tools > Options menu item, click the Preferences tab, and click the Log Results checkbox.

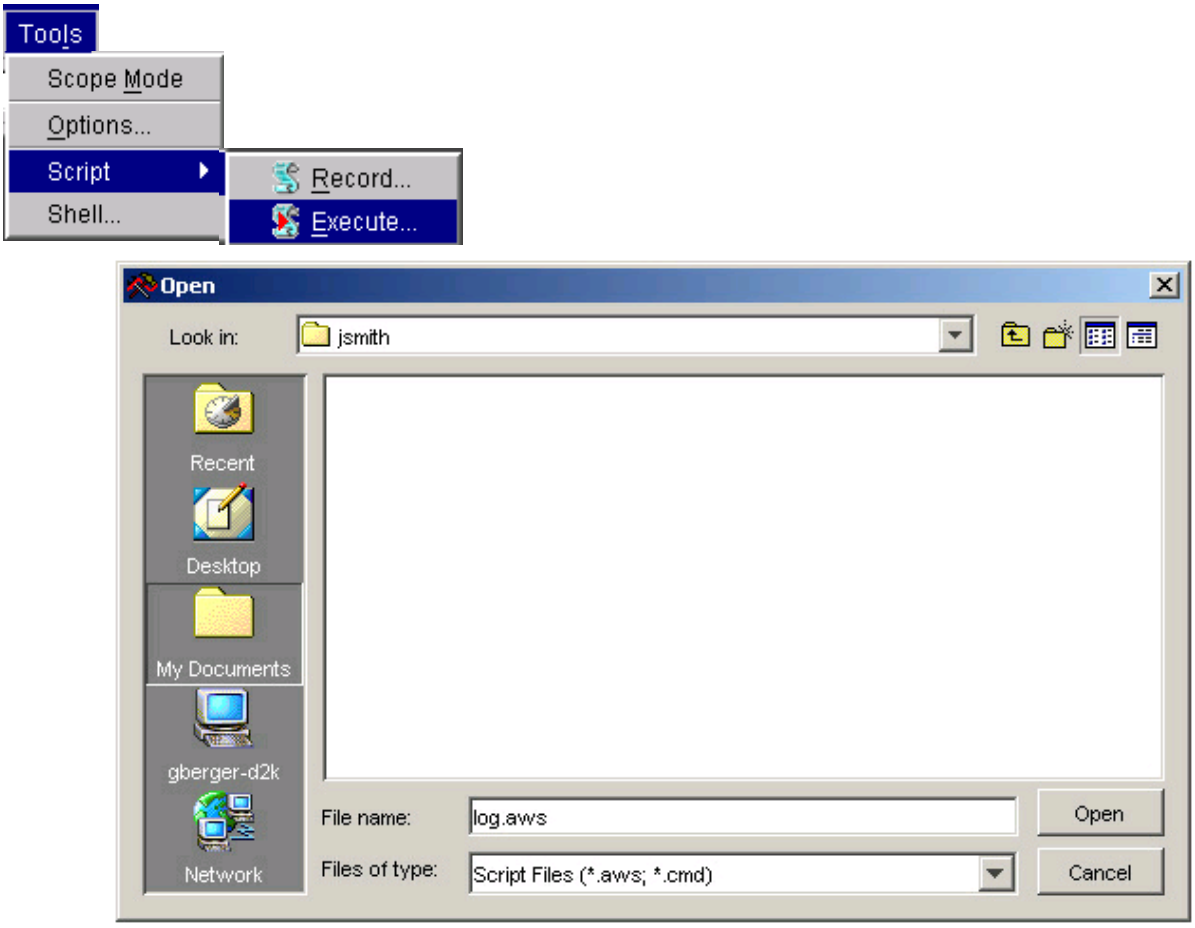
To end a recording session and close the script file:

1. Choose the menu item **Tools > Script > Record**.
2. Deselect the **Record to File** checkbox...or... click the **End Script Recording** icon on the toolbar.
3. Click **OK**.

NOTE — To ensure the data is complete, you must end the recording session and close the script file before editing or moving it.

The open script dialog box used to browse and select the file to execute is shown in Figure 161.

Figure 161. Execute Script Dialog Box



To execute a script:

1. Choose the menu item **Tools > Script > Execute**. From the **Execute** dialog, choose the script file to execute.

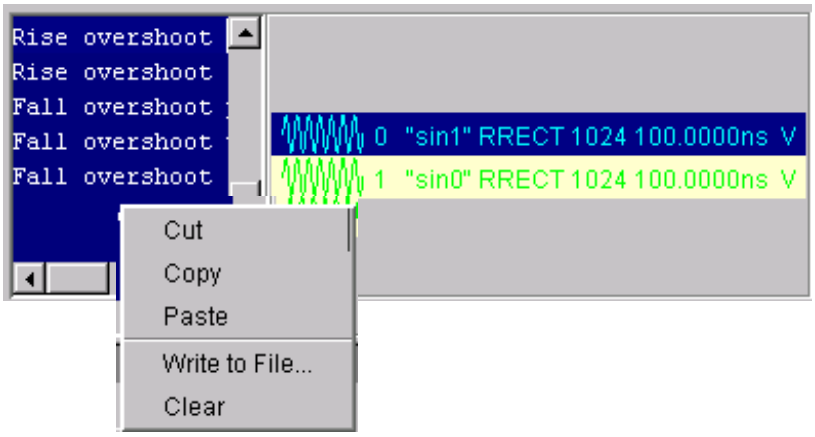
   If there is already an open script file, it is closed before the new file is opened.

2. Click **OK**.

Monitoring Errors, Warnings and Comments

The transcript pane section of the Analog Wavetool window, shown in Figure 162, is a scrollable text region that displays errors, warnings, and textual results. Although this is a scrollable region, it is limited. Also see Figure 139.

Figure 162. Transcript Pan with Drop Down Edit Menu



NOTE — The size of the transcript pane varies depending on the physical size of the Waveform tool.

To delete results from the transcript pane:

1. Select the text to be deleted.
2. Right-click in the transcript pane and choose the **Cut** menu item.

To copy results from the transcript pane to another editor:

1. Select the text to be copied.
2. Right-click in the transcript pane and choose the **Copy** menu item.
3. Open a text editor or other word processor and select the menu item **Edit > Paste**.

To copy text into the transcript pane:

1. In the source editor, select the text you wish to copy and choose **Edit** > **Copy**.
2. In the transcript pane, right-click and choose the **Paste** menu item.

To write the results of the transcript pane to a text file:

1. Right-click in the transcript pane and choose the **Write to File** menu item.
2. In the dialog, browse to the desired directory and choose a filename.
3. Click the **Save** button.

To delete all text in the transcript pane:

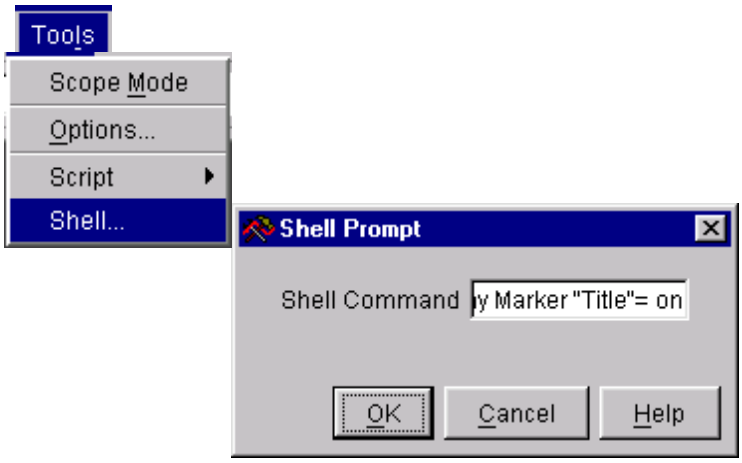
Right-click in the transcript pane and choose the **Clear** menu item.

Entering a Shell Command

To enter a shell command:

1. Click the menu item **Tools** > **Shell**. (This is the same as choosing the Calculator menu item **User** > **Shell**). See Figure 163.
2. Enter a shell command.
3. Click **OK**.

Figure 163. Shell Command Dialog Box



Executing Script Files: A Closer Look

A command interpreter is built into the Waveform tool. It allows script files to be executed to perform operations that are normally performed manually. These script files have the suffix *.aws or .cmd*. When the editor starts up, it performs the following script-file-related operations.

- Opens a file named `log.aws`. Most commands executed during a Wavetool session are written to this file. A different file can be specified using the script on name = <string> command, or from selecting the menu item **Tools** > **Script** > **Record** (or by clicking the **Begin Script Recording** icon in the toolbar). If the file cannot be opened, an error message is printed in the transcript pane section of the Analog Wavetool window.
- Looks for a file named *awtinit.cmd*, and if it exists, interprets the file. The local directory (the directory from which the Waveform tool is invoked) is checked first, then the users home directory, and finally the directory specified by the `AWED_DEFAULT_DIR` environment variable.

- Looks for files with the *.aws* or *.cmd* extensions, and assigns the found files to the user function buttons.

  By default, the **Documents and Settings\<username>** folder is checked. This can be changed at **Tools** > **Options** > **Default Locations**.

  If a button statement is in the file, that string is used as the button label. If no appropriate file is found in this location, the button is left undefined. Button labels are assigned *only* upon initialization of the Waveform tool.

All commands recognized by the Waveform tool user-command-interpreter are listed in Table 26.

<int> implies a decimal integer value

<double> implies a floating point number (that must include a decimal point and can include an exponent)

<string> implies a string. To protect special characters (including spaces), strings must be quoted: “a string.”

Apostrophes surround literals ('=') that must be entered exactly as indicated.

Values inside square brackets are options; one of the literals indicated must be used.

Table 26. Commands recognized by AWT user_command_Interpreter

Command	Meaning
abs ';'	Take the absolute value of top waveform on the stack.
add ';'	Add the top two waveforms on the stack.
add const '=' <double> ';'	Add a constant to each data point in the top waveform on the stack.
apply taper window '=' [rectang | triang | hanning | hamming | blackman | flattop] fract '=' <double> ';'	Applies the indicated window function to the indicated fraction of the TOS waveform.
apply kaiser fract '=' <double> appErr '=' <double> ';'	Applies a Kaiser window function to the indicated fraction of the TOS waveform with the specified approximation error.
apply chebyshev fract '=' <double> trans width '=' <double> ripple '=' <double> ';'	Applies a Chebyshev window function to the indicated fraction of the TOS waveform with the indicated transition width or ripple (one of the two values must be zero).
auto increment colors '=' [on | off] ';'	Turn automatic color assignment on or off. Turning off resets color to the default color (Color 1).

Table 26. Commands recognized by AWT user_command_Interpreter *(Cont.)*

Command	Meaning
average number '=' <int> ';'	Average the TOS waveform. Number specifies the number of times to average the waveform.
button '=' <string> ';'	Put a label on a user button, <string> is the label to use.
circular convolve ';'	Convolve the TOS waveform with the next-to TOS waveform.
clear ';'	Clear the waveform stack. No warning is given, the stack is just cleared.
clip ';'	Clip the top waveform on the stack according to the next waveform on the stack.
clip const '=' <double> ';'	Clip the top waveform on the stack to a constant value.
concatenate ';'	Places the TOS onto the end of the next-to TOS waveform.
convolve ';'	Convolve the top two waveforms on the stack. A linear convolution or a circular convolution can be chosen.
correlate ';'	Correlate the top two waveforms on the stack.
create band pass name '=' <string> sample rate '=' <double> low freq '=' <double> high freq '=' <double> length '=' <int> ';'	Creates a band pass filter waveform with the given parameters.
create band stop name = <string> sample rate '=' <double> low freq '=' <double> high freq '=' <double> length '=' <int> ';'	Creates a band stop (notch) filter waveform with the given parameters.
create brickwall name '=' <string> sample freq '=' <double> start freq '=' <double> stop freq '=' <double> number samples '=' <int>	Creates a mathematically ideal filter with the given parameters.
create cWeight name '=' <string> sample rate '=' <double> length '=' <int> ';'	Creates a C Message weighted filter (for use in telecom applications).
create cursor '=' <string> ';'	Creates a user cursor with the given name.
create dc name '=' <string> rate '=' <double> length '=' <int> offset '=' <double> ';'	Creates a DC waveform with the given parameters.

Table 26. Commands recognized by AWT user_command_Interpreter *(Cont.)*

Command	Meaning
create gauss name '=' <string> rate '=' <double> length '=' <int> seed '=' <int> mean '=' <double> std '=' <double> ';'	Creates a Gaussian noise distribution with the given parameters. If seed is not specified, a random seed value is generated.
create high pass name '=' <string> sample rate '=' <double> pass freq '=' <double> length '=' <int> ';'	Creates a high pass filter waveform with the given parameters.
create low pass name '=' <string> sample rate '=' <double> pass freq '=' <double> length '=' <int> ';'	Creates a low pass filter waveform with the given parameters.
create pulse name '=' <string> rate '=' <double> cycles '=' <int> points '=' <int> start '=' <double> rise '=' <double> width '=' <double> fall '=' <double> amp '=' <double> offset '=' <double> ';'	Creates a waveform consisting of pulses with the given parameters.
create pWeight name '=' <string> sample rate '=' <double> length '=' <int> ';'	Creates a psophometric weighted filter (for use in telecom applications).
create saw name '=' <string> rate '=' <double> cycles '=' <int> points '=' <int> start '=' <double> rise '=' <double> amp '=' <double> offset '=' <double>';'	Creates a waveform consisting of sawtooth cycles with the given parameters.

Table 26. Commands recognized by AWT user_command_Interpreter *(Cont.)*

Command	Meaning
create sine name '=' <string> cycles '=' <int> length '=' <int> rate '=' <double> phase '=' <double> amp '=' <double> offset '=' <double> ';'	Creates a sine waveform with the given parameters.
create triang name '=' <string> rate '=' <double> cycles '=' <int> points '=' <int> start '=' <double> rise '=' <double> fall '=' <double> amp '=' <double> offset '=' <double> ';'	Creates a waveform consisting of triangular cycles with the given parameters.
cursor track <string> <string> ';'	Set the second named cursor to track the first named cursor.
cursor untrack <string> ';'	Remove cursor tracking from the named cursor.
decimate factor '=' <int> ';'	Decimate the top waveform on the stack according to the indicated factor.
deinterleave name '=' <string> interleave factor '=' <int>	TBD
decode number bits '=' <int> code format '=' <int> ';'	Decode the TOS waveform according to the specified number of bits and code format. If code format indicates a-law, u-law, or BCD, the number of bits is not used.
differentiate ';'	Differentiate the top waveform on the stack.
display colors '=' [print | normal] ';'	Set the display colors to print (black on white) or normal.
display marker <string> '=' [on | off] ';'	Enable or disable the display of the named marker.
display mode '=' [user | points] ';'	Set the display mode to user units or points.
div ';'	Divide the top waveform on the stack by the next waveform on the stack.
div const_wf const '=' <double> ';'	Divide a constant by the top waveform on the stack.
div wf_const const '=' <double> ';'	Divide the top waveform on the stack by a constant.
drawing style '=' [line | point | sample | hist] ';'	Set the drawing style to line, point, sample mode, or histogram.

Table 26. Commands recognized by AWT user_command_Interpreter *(Cont.)*

Command	Meaning
eff bits full scale '=' <double> fconv '=' <double> phconv '=' <double> ';'	Determine the effective bits of the top of stack waveform based on the parameters given.
fft ';'	Find the Fast Fourier Transform of the top waveform on the stack.
find level <string> '=' <double> [rising | falling | either] ';'	Cause the named cursor to find the indicated level on a rising, falling or either rising or falling edge.
graticule '=' [cartesian | grid | scale | off] ';'	Select the graticule type, Cartesian, grid, scale or off.
histogram type '=' [normal | weighted] size '=' <int> ';'	Generate a histogram of the TOS waveform. Size must be a power of two.
ifft ';'	Find the Inverse Fast Fourier Transform of the top waveform on the stack.
inl dnl ramp segs '=' <int> bits '=' <int> ramps '=' <int> mag '=' <double> vref '=' <double> offset '=' <double> ';'	Find Integral and Differential Non-Linearity of the top of stack waveform based on the given parameters. The top of stack waveform must be a linear ramp or set of ramp segments.
inl dnl sine full scale '=' <double> amp '=' <double> threshold '=' <int> ';'	Find Integral and Differential Non-Linearity of the top of stack waveform based on the given parameters. The top of stack waveform must be sine wave.
interleave name '=' <string> interleave factor '=' <int> ';'	Interleave takes a set of waveforms and combines them to produce a single waveform. This is the inverse of the 'deinterleave' function. Interleave name is the waveform name of the resulting interleaved waveform. Interleave factor is the number of waveforms on the stack to combine to produce the output waveform. Note that all the waveforms to interleave must have the same number of samples.
intermod dist full scale '=' <int> first freq '=' <double> second freq '=' <double> ';'	Find the intermodulation distortion of the top of stack waveform based on the parameters given.
linear convolve ';'	Performs a mathematical linear convolution of top two waveforms on the stack.
log base '=' <double> ';'	Take the log of each data point in the top waveform on the stack.

Table 26. Commands recognized by AWT user_command_Interpreter *(Cont.)*

Command	Meaning
log results [on | off] ';'	Enable or disable logging of results in the log file. When on, any results that print in the transcript pane are also printed as comments in the log file.
mark results [on | off] ';'	Enable or disable the creation of markers for the results of measurements. When on, results of simple measurements (mean_std, minmax, pulse measurements, etc.) have markers of type. Results added to the appropriate location in the waveform.
mean_std ';'	Find the mean and standard deviation of the top of stack waveform.
median ';'	Find the median of the top of stack waveform.
minmax [start '=' <double> stop '=' <double>] ';'	Find the minimum and maximum data points in the top waveform on the stack. If start and stop values are provided, only the region between these values is checked. If no values are provided, the entire waveform is checked.
mult ';'	Multiply the top two waveforms on the stack.
mult const '=' <double> ';'	Multiply the top waveform on the stack by a constant.
norm ';'	Normalize the top waveform on the stack (max = 1.0, min = 0.0).
polar ';'	Convert the complex rectangular waveform on the top of the stack into a polar waveform.
polar splice ';'	Convert the top two real rectangular waveforms on the stack into a single polar waveform.
pop ';'	Pop the top waveform off the stack. The waveform is lost.
power base '=' <double> ';'	Raise base to the power of the data value in the TOS waveform. Note that the calculator button for this command is labeled Power (base ^ wf).
power exp '=' <double> ';'	Raise each data point in the TOS waveform to the indicated exponent. Note that the calculator button for this command is labeled Power (wf ^ exp).
pulse all start '=' <double> stop '=' <double> range '=' <double> level algo '=' [mode | mean] cross cnt '=' <int> proximal '=' <double> mesial '=' <double> distal '=' <double> ';'	Measures all pulse parameters except settling time. These include amplitude, rise time, fall time, period, and duty factor (or pulse width) and rising and falling overshoot or preshoot.

Table 26. Commands recognized by AWT user_command_Interpreter *(Cont.)*

Command	Meaning
pulse amplitude start '=' <double> stop '=' <double> range '=' <double> level algo '=' [mode | mean]	Measures the pulse high and low values and the amplitude of the pulse (high - low).
pulse fall start '=' <double> stop '=' <double> range '=' <double> level algo '=' [mode | mean] cross cnt '=' <int> proximal '=' <double> distal '=' <double> ';'	Measures the fall time of the falling edge of the pulse. The locations of the proximal, mesial, and distal points are also printed.
pulse overshoot start '=' <double> stop '=' <double> range '=' <double> level algo '=' [mode | mean]	Measures the rising and falling overshoot percentage, peak pulse value and location of the peak based on the supplied parameters. Results for both the rising and falling edges are printed. If the preshoot amplitude is greater than the overshoot, this value is computed instead.
pulse period start '=' <double> stop '=' <double> range '=' <double> level algo '=' [mode | mean] cross cnt '=' <int> mesial '=' <double> ';'	Measures the period and duty cycle (if three edges are included between the indicated indexes) or pulse width (if only two edges are included between the indicated indexes) of the pulse.
pulse rise start '=' <double> stop '=' <double> range '=' <double> level algo '=' [mode | mean] cross cnt '=' <int> proximal '=' <double> distal '=' <double> ';'	Measures the rise time of the rising edge of the pulse. The locations of the proximal, mesial and distal points are also printed.
pulse settle start '=' <double> stop '=' <double> stable '=' <double> level period '=' <double> delta '=' <double> ';'	Measures the settling time based on the supplied start and stop indexes, stable period, level period, and allowable signal delta. No interpolation is done in this function.
push ';'	Duplicate the TOS waveform.
push2 ';'	Duplicate the top two waveforms on the stack.

Table 26. Commands recognized by AWT user_command_Interpreter *(Cont.)*

Command	Meaning
ratios harm '=' <int> ';'	Finds the signal-to-noise ratio (SNR), signal-to-distortion ratio (SDR) and signal-to-noise-and-distortion ratio (SNDR). The number of harmonics to include must be provided. If this value is -1, all harmonics are included.
read awav <string> ';'	Read the indicated AWAV file and push it onto the top of the stack. If an ADIF file is specified, it is read.
read awg <string> ';'	Read the indicated AWG (Arbitrary Waveform Generator) file and push it onto the top of the stack.
read cap <string> ';'	Read the indicated CAP (Capture Processor) file and push it onto the top of the stack.
read cmd <string> ';'	Read and execute the indicated command file.
recall <int> ';'	Recall the waveform from indicated register and push it onto the stack.
rectang splice ';'	Convert the top two real rectangular waveforms on the stack into a single complex rectangular waveform.
remove cursor <string> ';'	Remove the named cursor.
reverse ';'	Reverse the top waveform on the stack: last data point becomes first, second to last becomes second, etc.
rotate [up | down] ';'	Rotate the waveform stack up or down by one waveform.
scope acquire ;	Digitize the data on the current pins using the current setup values.
scope auto = [on | off] ;	Enable or disable auto update mode.
scope pins = %s ;	Set the pin, pins or pin lists for which to acquire data.
scope points = %d ;	Set the number of data points to acquire.
scope reference [vector = %d | cycle = %d | time = [%s | %g] | scan = %d : %d | pin = %s] ;	Set the reference value to a vector, cycle, time, scan partition: link, or pin. Time can be set as 1.0e-6 or 1u (1 microsecond).
scope sample interval = [%s | %g] ;	Set the time interval between samples (T reso). Time can be set as 1.0e-6 or 1u (1 microsecond).
scope start = [%s | %g] ;	Set the start time (Tmin) for acquisition relative to the reference point. Time can be set as 1.0e-6 or 1u (1 micro second).
scope stop = [%s | %g] ;	Set the stop time (Tmax) for acquisition relative to the reference point. Time can be set as 1.0e-6 or 1u (1 micro second).
scope vmax = [%s | %g] ;	Set the maximum voltage to be checked. Voltage can be set as 5.00e-1 or 500m (500 millivolts).

Table 26. Commands recognized by AWT user_command_Interpreter *(Cont.)*

Command	Meaning
scope vmin = [%s | %g] ;	Set the minimum voltage to be checked. Voltage can be set as 5.00e-1 or 500m (500 millivolts).
scope vreso = [%s | %g] ;	Set the voltage resolution for acquisition. Voltage can be set as 5.00e-1 or 500m (500 millivolts).
script on [name '=' <string>] ';'	Turn output to the log file on. If no name is specified, the current default (last name specified) is used. If a different log file is currently open, it is closed before the new file is opened.
script off ';'	Turn output to the log file off and closes the log file.
segment start '=' <double> stop '=' <double>';'	Extract a section from the TOS waveform. The start value is the time index of the first sample from the TOS waveform to include in the extracted waveform. The stop value is the time index of the last sample from the TOS waveform to include in the extracted waveform.
serial to parallel resample start '=' <double> resample rate '=' <double> resample threshold '=' <double> [lsb/msb] first number bits '=' <int> display [tscript|waveform|both]';'	TBD
set <int> display color '=' [default | 1 .. 32] ';'	Set the color of the indicated waveform to the indicated value.
set <int> display y center '=' <double> ';'	Set the indicated waveform such that the indicated value is at the center of the display patch.
set <int> display y pan '=' <double> ';'	Set the top of the indicated waveform to be the indicated percentage of the waveform.
set <int> display y scale '=' <double> ';'	Set the Y scale factor of the indicated waveform to the indicated value.
set <int> super '=' [on | off] ';'	Turn superimpose on or off for the indicated waveform.
set <int> wave component '=' [value | [real | imag] | [mag | phase]] ';'	Select the waveform component to display for the indicated waveform.
set <int> wave data '[' <int> ']' '=' <double> ';'	Set the waveform data value in the indicated waveform at the index specified in brackets to the indicated data value (double).
set <int> wave name '=' <string> ';'	Set the name of the indicated waveform.

Table 26. Commands recognized by AWT user_command_Interpreter *(Cont.)*

Command	Meaning
set <int> wave offset '=' <double> ';'	Set the X offset for the specified waveform. The offset is the X value of the first data point in the waveform data array.
set <int> wave phase units '=' <string> ';'	Set the phase units string for the indicated waveform. (Only valid if waveform type is polar.)
set <int> wave sample rate '=' <double> ';'	Set the sample rate of the indicated waveform to the specified value.
set <int> wave x units '=' <string> ';'	Set the X units string for the indicated waveform.
set <int> wave y units '=' <string> ';'	Set the Y units string for the indicated waveform.
set cursor location <string> '=' <double> ';'	Set the named cursor to the indicated location (X coordinate).
set cursor waveform <string> '=' <int> ';'	Set the named cursor to the indicated waveform (0 = top of stack).
set display x begin '=' <double> ';'	Set the display such that the indicated value is at the beginning (left side) of the display.
set display x pan '=' <double> ';'	Set the X display to begin at the indicated percentage of the waveform.
set display x scale '=' <double> ';'	Set the X scale factor to the indicated value.
set edit mode '=' [light | heavy] ';'	Set the editor to the specified mode.
set waveform size '=' [small | medium | large] ';'	Set the size of a waveform patch to be the indicated value.
shell prompt <string> ';'	Pop up the shell prompt input box with the specified string. The string can be edited before being submitted to a shell or the input box can be cancelled without performing the indicated shell command.
shell <string> ';'	Execute the command in string by submitting it to a shell.
simp integr ';'	Perform a Simpson integration of the waveform on the top of the stack.
sin curve fit fconv '=' <double> phconv '=' <double> start freq '=' <double> ';'	Find the sine wave that most closely fits the TOS waveform.
sin interp factor '=' <int> ';'	Perform a sine interpolation of the waveform on the top of the stack using the indicated factor.
split ';'	Split the complex rectangular or polar waveform on the top of the stack into two real rectangular waveforms.
sqrt ';'	Take the square root of each data point in the top waveform on the stack.

Table 26. Commands recognized by AWT user_command_Interpreter *(Cont.)*

Command	Meaning
store <int> ';'	Store the waveform on the top of the stack into the indicated register.
sub ';'	Subtract the next to top of stack waveform from the top of stack waveform.
sub const '=' <double> ';'	Subtract a constant from the top of stack waveform.
swap ';'	Swap the top waveform on the stack with the next waveform on the stack.
sync y '=' [on | off] ';'	Set the Y axes synchronize on or off.
tester connect <string> head '=' [1 | 2] ';'	Connect to the specified tester and test head.
tester disconnect ';'	Disconnect from the currently connected tester.
tester read <string> mode '=' [read | auto | retrace] cmd '=' [on | off] [cmd name '=' <string>] ':'	Read a waveform from the tester. A connection must already be established. The first string is the full path to the desired waveform on the tester. Mode specifies the update mode. If cmd is set to on, command file processing is enabled, it is disabled otherwise. If no command file is specified by this command, command file processing is disabled regardless of the cmd value specified. The command file name is optional.
tester update <string> mode '=' [read | auto | retrace] cmd '=' [on | off] [cmd name '=' <string>] ':'	Modify the parameters of a waveform connected to the tester. The first string is the name of the waveform as it appears in the name field of the waveform patch. If multiple waveforms with the same name are attached to the tester, the specified parameters are applied to all waveforms of the specified name. The read mode, command file enable and, optionally, the command file name are modified.
tester write <string> ';'	The TOS waveform is written to the tester waveform specified by the string. The tester connection must already be established and the specified destination waveform must be the full path of the waveform on the tester.
trap integr ';'	Perform trapezoidal integration of the waveform on the top of the stack.
tscript print <string> ';'	Prints the string in the transcript pane.
tscript read <string> ';'	Opens the file specified by the string and prints the contents of the file in the transcript pane.

Table 26. Commands recognized by AWT user_command_Interpreter *(Cont.)*

Command	Meaning
unscramble cycles '=' <int> ';'	Rearranges samples by skipping the entered number of samples. It wraps around the last sample and continues from the first sample until all samples are rearranged. This can be used to view samples in phase order instead of time order. This has been replaced by the Reorder input cycles function, which provides more control over the reordering process.
write ascii awav <string> ';'	Write the waveform on the top of the stack to the indicated file in ASCII AWAV format. ADIF format is no longer supported for writing waveforms.
write awg ';'	Write the waveform on the top of the stack in AWG format. The file name is derived from the waveform name.
write parallel swav <string> number bits '=' <int> scale '=' <double> offset '=' <double> interleave factor '=' <int> code format '=' <int> ';'	Write the waveform on the top of the stack to the indicated file in parallel SWAV format based on the given parameters.
write serial swav <string> number bits '=' <int> scale '=' <double> offset '=' <double> [lsb | msb] first code format '=' <int> ';'	Write the waveform on the top of the stack to the indicated file in serial SWAV format based on the given parameters.
zoom <int> display y [up | down]';'	Go to the next higher (up) or lower (down) scale factor for the Y axis of the indicated waveform.
zoom cursor <string> <string> ';'	Zoom the X axis between the two named cursors. All waveforms with the same units as the waveform(s) included by the indicated cursors are zoomed.
zoom display x [up | down]';'	Go to the next higher (up) or lower (down) scale factor for the X axis. All waveforms with units the same as the TOS waveform are rescaled.
zoom previous <string> ';'	Restore the previous X and Y scale and position values for the waveform for the indicated cursor.
zoom region <string> <string> ';'	The same as zoom cursor but the Y axis of the waveform(s) for the indicated cursors is zoomed as well.

Printing a Waveform

To print a waveform:

1. Choose the menu item **File** > **Print** or click the **Print** icon in the toolbar.
2. In the dialog that displays, choose what you wish to print.
3. **Print TOS Waveform** — Prints only the TOS waveform with pertinent information about the waveform, minus the cursor.
4. **Print Stack View** — Prints everything on the screen, including the Name Pane, all patches shown, the cursors, and the cursor boxes.
5. Click **OK**.
6. Set the rest of the print preferences, click **OK**.

Closing a Waveform

To close a waveform file:

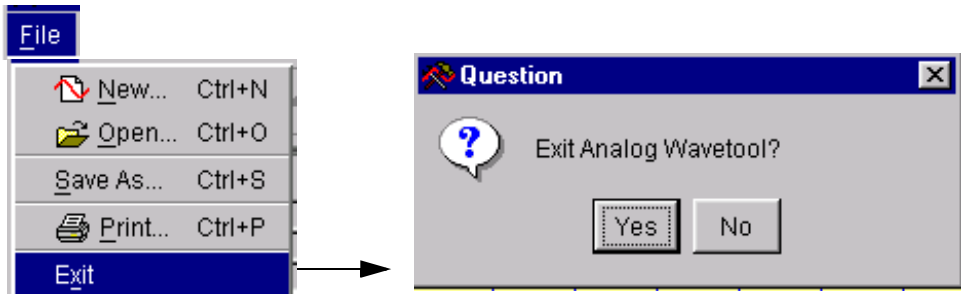
1. Move the waveform to be closed to TOS.
2. In the display button area (lower left corner of the tool), click the Pop button.

Exiting the Analog Wavetool

To exit the Analog Wavetool:

- Choose the menu item **File** > **Exit**.
- Click **Yes**. (See Figure 164.)

Figure 164. Exit Dialog Box



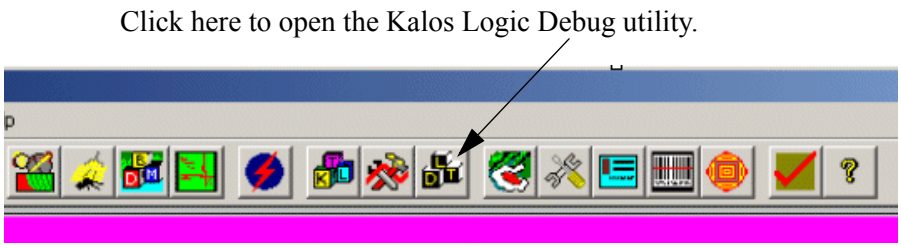
Logic Debug Tool

The Logic Debug tool (LDTool) is a front-end application intended for advanced debugging, editing, and running of test patterns, as well as viewing the results of running stored patterns in History RAM. The LDTool displays the correspondence between pattern and History RAM fail data, failing pins and fail counts, and allows bitwise editing and rerunning of patterns for acquiring new fail data.

LDTool automatically detects the LVM mode and displays it in the status bar of the main LDTool window. The following LVM modes are supported: 48x1, 48x2, 96x1, 96x2, 96x4, 192x1, and 192x2, 384x1, 384x2, 384x4, 768x1, 768x2 and 768x4.

The LDTool (*utility*) is launched by clicking on the Kalos Logic Debug icon (see Figure 165) or it can be selected (launched) from the Utilities menu item.

Figure 165. LD Icon



The main window of the LDTool operates in the following modes:

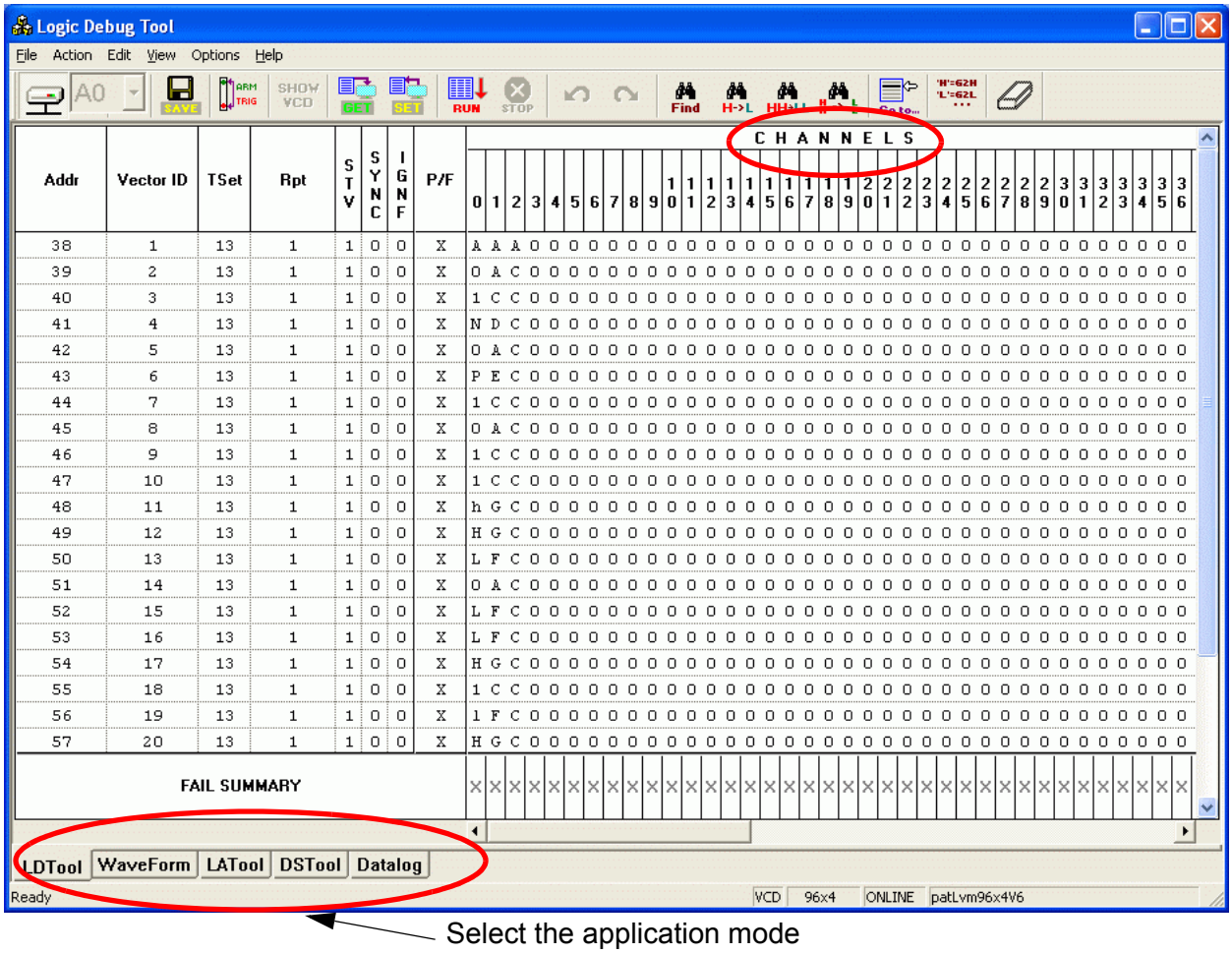
- LDTool
- Waveform
- LATool
- DSTool
- Datalog

The desired mode is selected by clicking the corresponding tab at the bottom left of the main window (see Figure 166).

LDTool Window

The main LDTool window (Figure 166) displays the currently loaded pattern and allows bitwise editing and rerunning, as well as displaying the newly acquired fail data.

Figure 166. LDTool Window



Pattern data is displayed in a column format. The following data is provided (column information noted as (*editable*) can be edited):

Addr	Pattern address in SRAM.
Vector ID	Sequential number of the current vector in the **.kpl** file.
FSet	Format set.
TSet	Timing set.
Rpt	Repeat counter (editable).
STV	Store This Vector; *1* sets the current vector to be stored in History RAM (editable).

SYNC	(editable)
IGNF	Ignore fail; *1* sets the failed address to be shown in the LDTool window like the addresses with no fail are shown (editable).
P/F	Pass/Fail; **X**, if there is no information; **FAIL (**in red), if fail occurred; **Pass** (in green), if passed without fail.
CHANNELS/DEVICE PINS	This field displays the current vector data by channels (see Figure 166) or device pins (see Figure 167) in source format (editable). The column headers display channel numbers, or device pins. The corresponding names below the channel or pin numbers (see Figure 168) can also be displayed from the column header context menus. If the names are not displayed, point the cursor to the column header to display the name.

Figure 167. Vector Data Shown by Device Pins

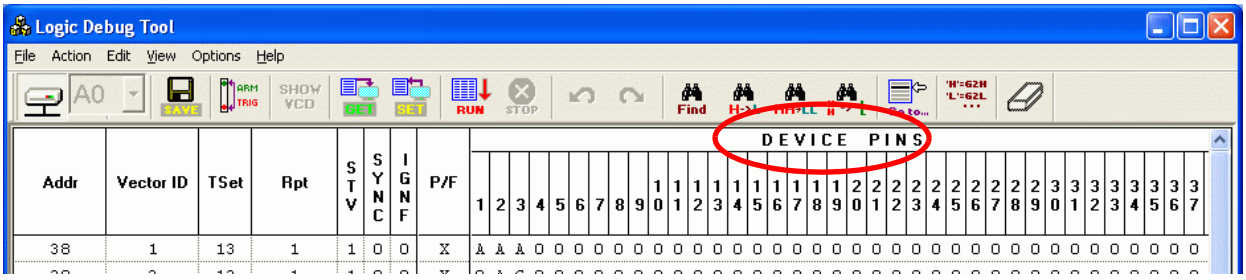
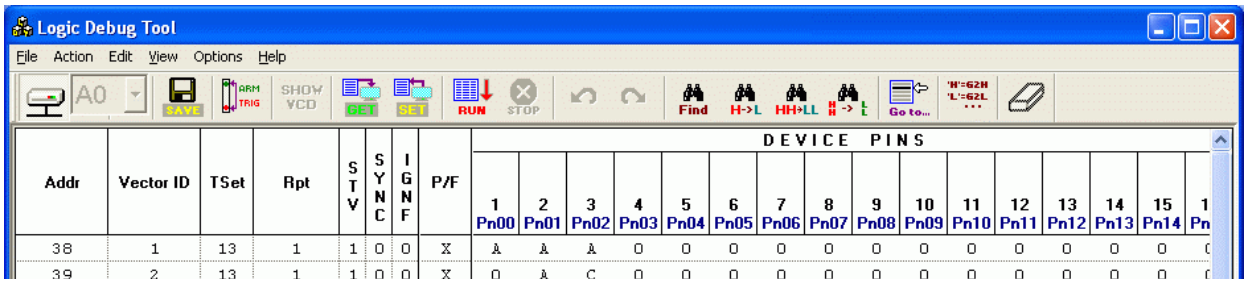


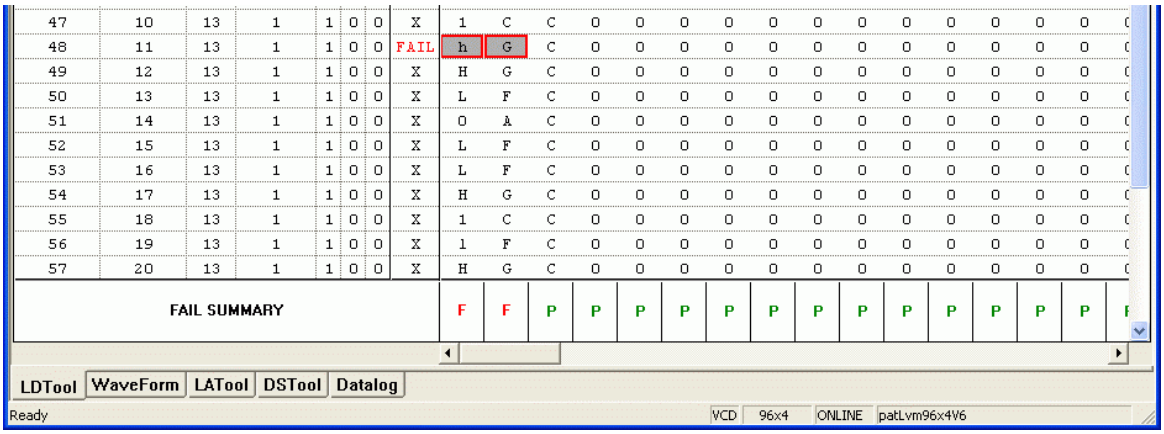
Figure 168. Device Pin Numbers Shown With Names



FAIL SUMMARY for each channel is shown on the last row of the column (see Figure 169). The fail summary for a channel can be **P** (Pass), **F** (Fail), or **X** (no pass/fail information is available) (see Figure 169). Placing the cursor over the column displays the number of fails that occurred for a channel, or to indicate *no pass/fail information for this channel*.

Fail/Pass without showing the numbers of the occurred fails is indicated in Figure 169.

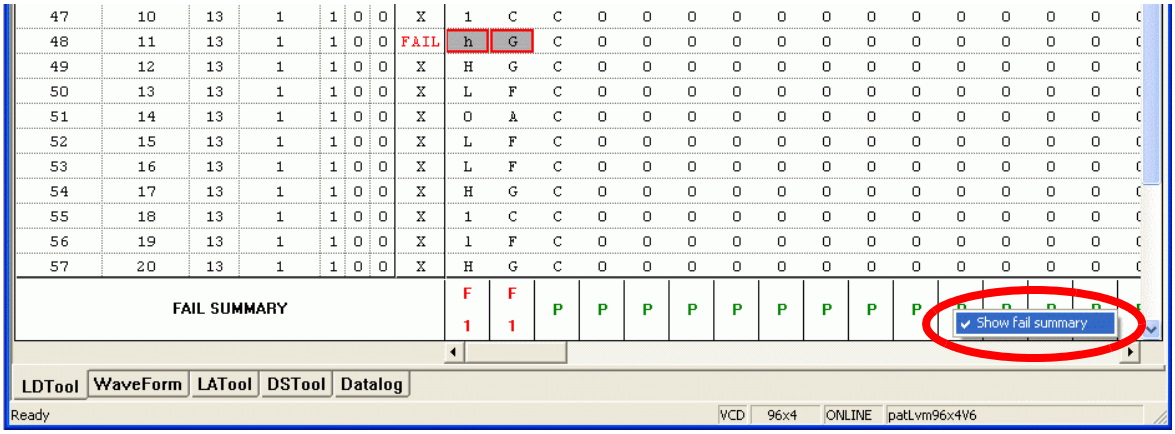
Figure 169. Fail/Pass



If in the context menu of the **Fail Summary** row, the **Show fail summary** item is checked then the number of the occurred fails for each failed channel is shown below the symbol "**F**" (see Figure 170).

In Figure 170, Failed channels/pins indicated along with the numbers of the occurred fails.

Figure 170. Fail Channel Pins



If a vector data of some vector and pin is shown with gray background and red border (H), it indicates fail fixed for that data.

The headers of the **CHANNELS/DEVICE PINS** columns are provided with the following context menu:

Displays the Channels dialog for selecting the channels to be shown

Shows the current vector data by channels if checked
Shows the current vector data by device pins if checked

Shows the names of channels or device pins if checked

Check/uncheck these

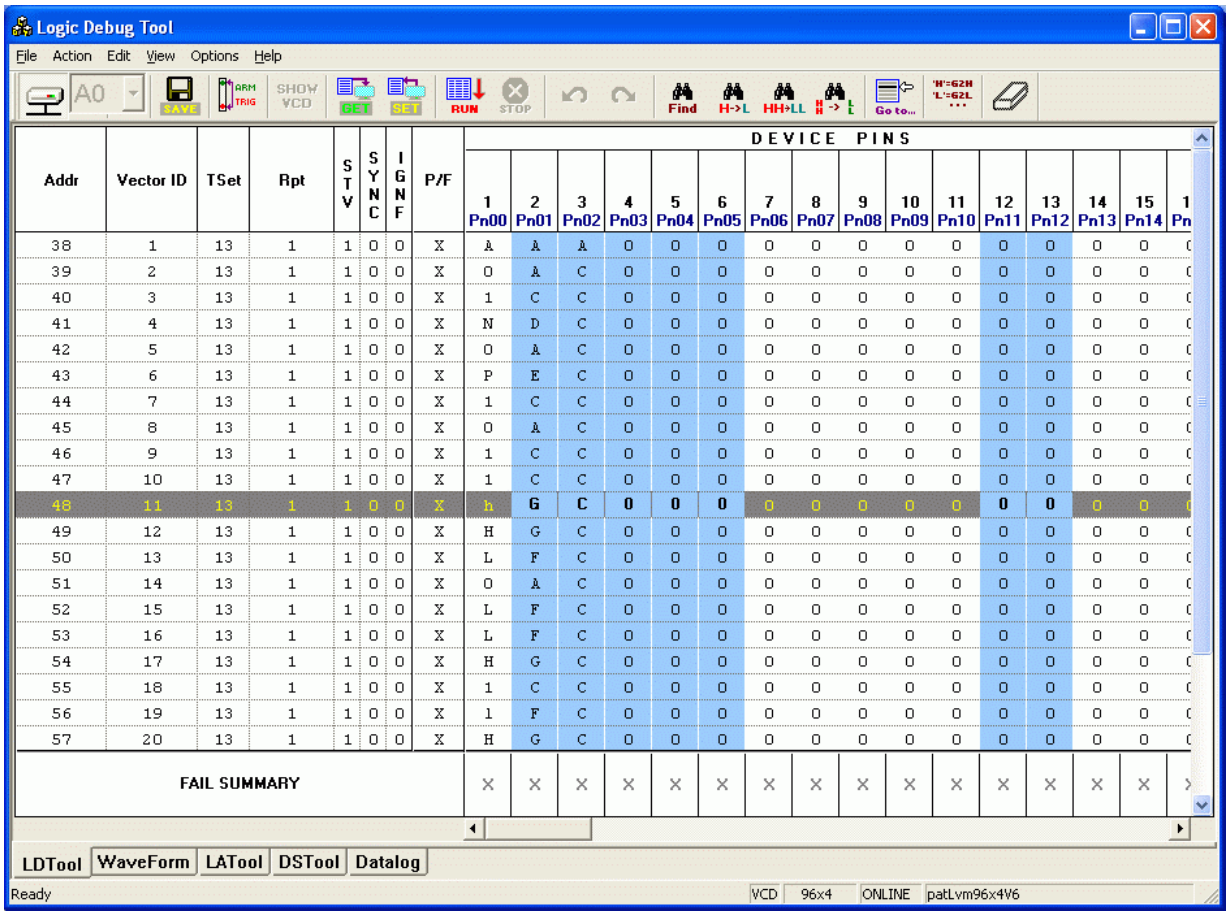
items to show/hide the

corresponding data columns

User can select any row in the **LDTool** window by clicking that row, and/or select columns by clicking their headers. For better visibility the selected row is highlighted in dark gray, and the selected column(s) in blue.

In Figure 171, the selected row and columns are highlighted.

Figure 171. Row and Column Selection


Logic Debug Tool
File Action Edit View Options Help
LDTool WaveForm LATool DSTool Datalog
Ready VCD 96x4 ONLINE patLvm96x4V6

Addr	Vector ID	TSet	Rpt	STV	SYNC	IGNF	P/F	DEVICE PINS 1 Pn00	2 Pn01	3 Pn02	4 Pn03	5 Pn04	6 Pn05	7 Pn06	8 Pn07	9 Pn08	10 Pn09	11 Pn10	12 Pn11	13 Pn12	14 Pn13	15 Pn14
38	1	13	1	1	0	0	X	A	A	A	0	0	0	0	0	0	0	0	0	0	0	0
39	2	13	1	1	0	0	X	0	A	C	0	0	0	0	0	0	0	0	0	0	0	0
40	3	13	1	1	0	0	X	1	C	C	0	0	0	0	0	0	0	0	0	0	0	0
41	4	13	1	1	0	0	X	N	D	C	0	0	0	0	0	0	0	0	0	0	0	0
42	5	13	1	1	0	0	X	0	A	C	0	0	0	0	0	0	0	0	0	0	0	0
43	6	13	1	1	0	0	X	P	E	C	0	0	0	0	0	0	0	0	0	0	0	0
44	7	13	1	1	0	0	X	1	C	C	0	0	0	0	0	0	0	0	0	0	0	0
45	8	13	1	1	0	0	X	0	A	C	0	0	0	0	0	0	0	0	0	0	0	0
46	9	13	1	1	0	0	X	1	C	C	0	0	0	0	0	0	0	0	0	0	0	0
47	10	13	1	1	0	0	X	1	C	C	0	0	0	0	0	0	0	0	0	0	0	0
48	11	13	1	1	0	0	X	h	G	C	0	0	0	0	0	0	0	0	0	0	0	0
49	12	13	1	1	0	0	X	H	G	C	0	0	0	0	0	0	0	0	0	0	0	0
50	13	13	1	1	0	0	X	L	F	C	0	0	0	0	0	0	0	0	0	0	0	0
51	14	13	1	1	0	0	X	0	A	C	0	0	0	0	0	0	0	0	0	0	0	0
52	15	13	1	1	0	0	X	L	F	C	0	0	0	0	0	0	0	0	0	0	0	0
53	16	13	1	1	0	0	X	L	F	C	0	0	0	0	0	0	0	0	0	0	0	0
54	17	13	1	1	0	0	X	H	G	C	0	0	0	0	0	0	0	0	0	0	0	0
55	18	13	1	1	0	0	X	1	C	C	0	0	0	0	0	0	0	0	0	0	0	0
56	19	13	1	1	0	0	X	1	F	C	0	0	0	0	0	0	0	0	0	0	0	0
57	20	13	1	1	0	0	X	H	G	C	0	0	0	0	0	0	0	0	0	0	0	0
FAIL SUMMARY								X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

The keys “**Up Arrow**” and “**Down Arrow**”, “**Page Up**” and “**Page Down**”, “**Home**” and “**End**” are available for moving the selection of row up and down.

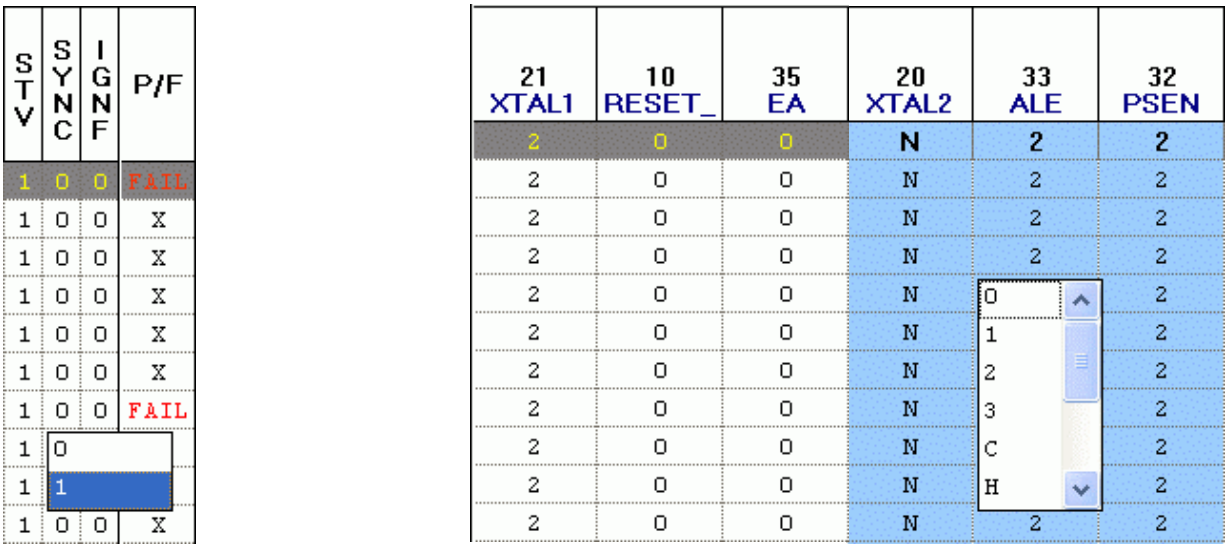
The vector data in the **LDTool** window are shown in correspondence with the **VectorChar** definition defined in the current test program. An example of **VectorChar** definition is presented below:

```
VectorChar {
    0 = DD1,  DD2,  EMASK1, EMASK2  (0, 0, 0, 1);
// G2L, G2L, DC, DC
    1 = DD1,  DD2,  EMASK1, EMASK2  (0, 1, 1, 1);
// G2H, G2H, DC, DC
    N = DD1,  DD2,  EMASK1, EMASK2  (0, 0, 1, 1);
// G2L, G2H, DC, DC
    P = DD1,  DD2,  EMASK1, EMASK2  (0, 1, 0, 1);
// G2H, G2L, DC, DC
    L = DD1,  DD2,  EMASK1, EMASK2  (1, 0, 0, 0);
```

```
// G2Z, G2Z, EL, EL
    H = DD1,  DD2,  EMASK1, EMASK2  (1, 1, 1, 0);
// G2Z, G2Z, EH, EH
    X = DD1,  DD2,  EMASK1, EMASK2  (1, 0, 0, 1);
// G2Z, G2Z, DC, DC
    n = DD1,  DD2,  EMASK1, EMASK2  (1, 0, 1, 0);
// G2Z, G2Z, EL, EH
    p = DD1,  DD2,  EMASK1, EMASK2  (1, 1, 0, 0);
// G2Z, G2Z, EH, EL
};
```

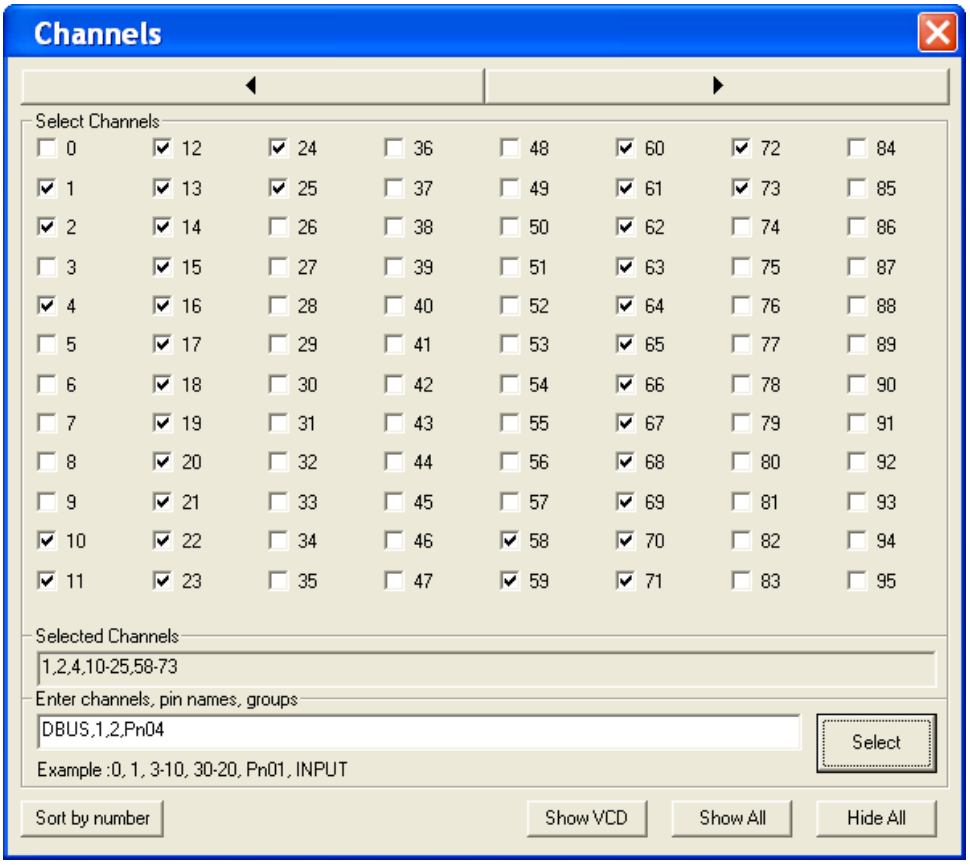
Users can right-click any editable cell in the **LDTool** window and select the desired value from the pop-up list of the available values (see Figure 172).

Figure 172. Cell Selection



The **Channels** dialog allows the user to select the channels to be displayed in the **LDTool** window.

Figure 173. Channels Dialog



The check marks in the **Select Channels** field indicate the currently selected channels.

Click the left/right spin buttons at the top of the dialog to view to the desired channel range.

Check/uncheck the check boxes to select the desired channels.

The **Selected Channels** field shows the selected channels.

Type the desired channel numbers, and/or pin/group names in the **Enter channels, pin names, groups** field and click the **Select** button to check the corresponding check boxes and to display the data of the selected channels in the **LDTool** window.

Click the **Sort by number** button to show the selected channels in the **LDTool** window sorted by their numbers.

Click the **Show VCD** button to show all channels in the **LDTool** window in the same order as defined in the pattern file.

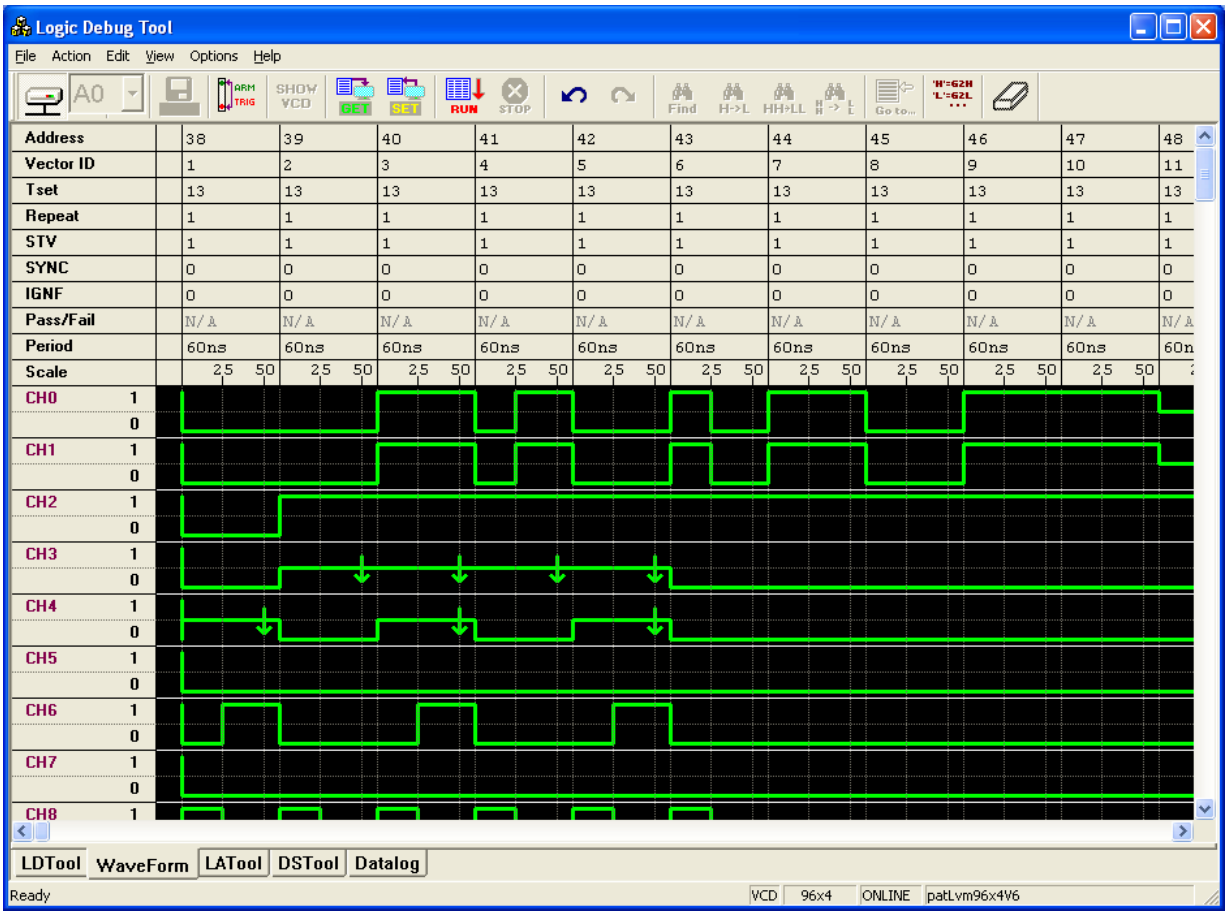
Click **Show All** to show all channels (0-767) sorted by their numbers.

Click **Hide All** to hide all channels in the **LDTool** window.

Waveform Window

This window shows the data presented in the **LDTool** window by means of waveforms.

Figure 174. WaveForm Window



The conventional symbols used in this window are described in the first five rows of the.

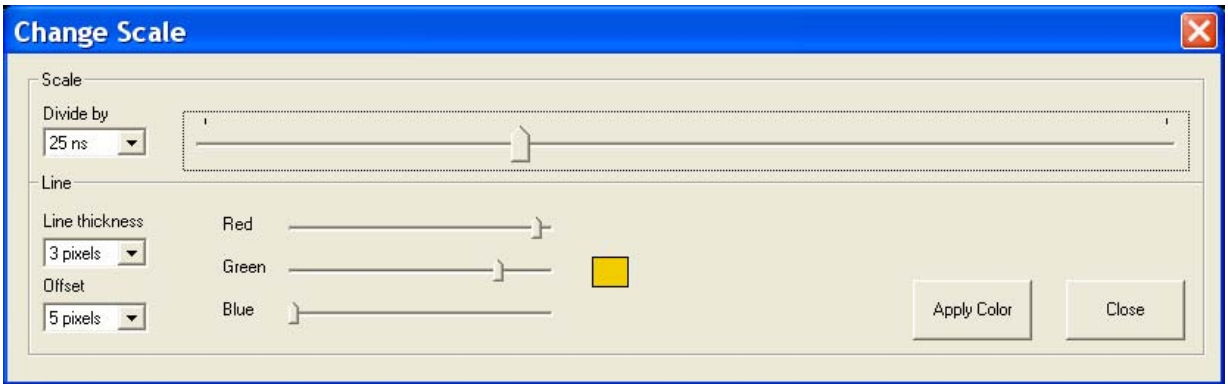
The leftmost column in the **WaveForm** window is provided with the same context menu as the headers of the **CHANNELS/DEVICE PINS** columns in the LDTool window.

The **Scale** row presents the time scale. The values of time points are presented in terms of ns. The scale is provided with the following context menu:

Change Scale Dialog

This dialog allows the user to set the index by choosing the desired value from the Index combo box, or by moving the slider at its right.

Figure 175. Change Scale Dialog.

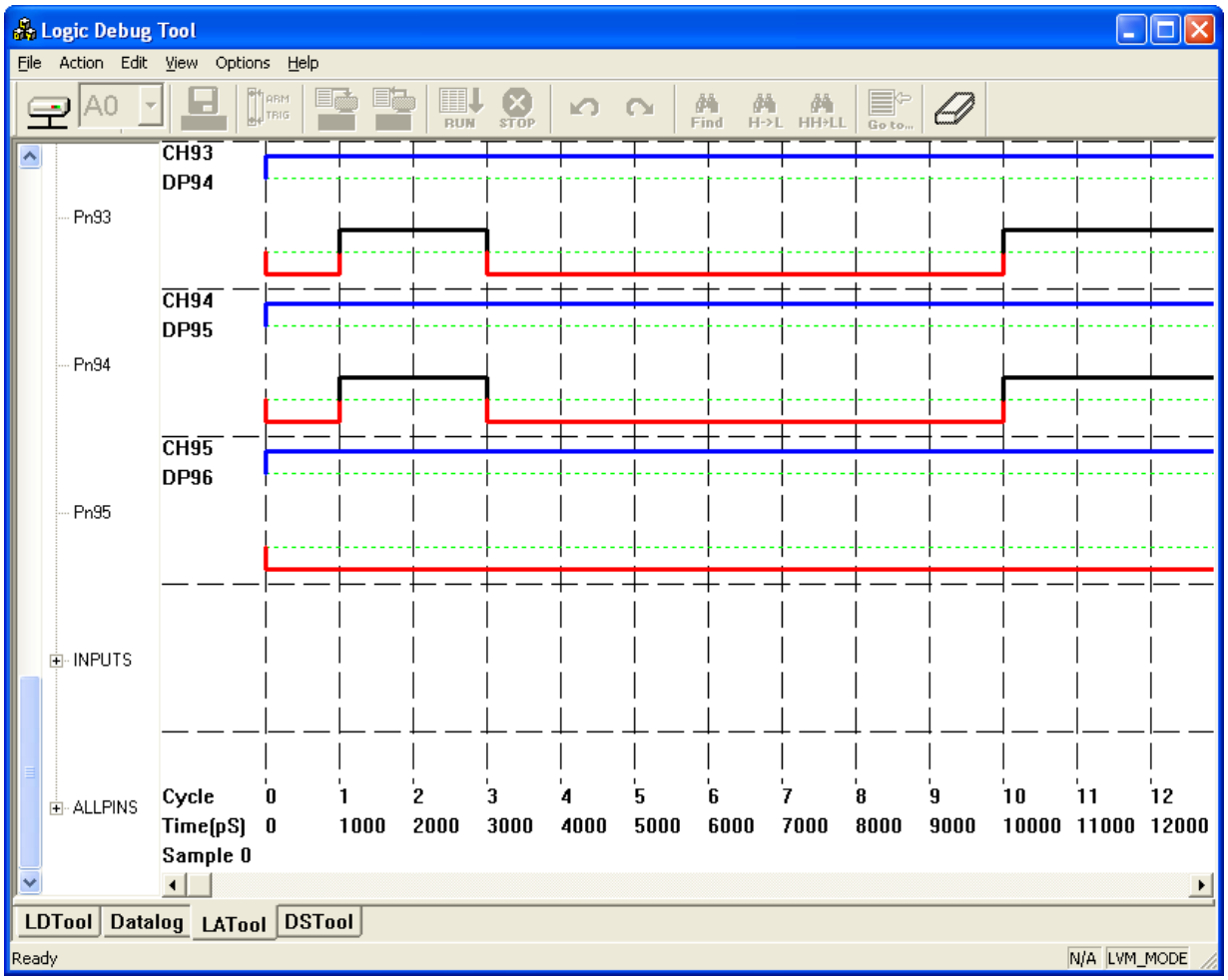


Users can also set the thickness of the waveform lines using the **Line thickness** combo box, as well as the line color using the sliders for **Red**, **Green** and **Blue**.

LATool Window

This window provides graphical view of the programmed pattern waveforms and actual measured waveforms for the selected pins or pin groups.

Figure 176. LATool Window



The corresponding information can be saved to a **.lat** file, which can be opened in both online and offline modes through the context menu of the LATool window.

The first column shows the names of the selected pins and pin groups. [+] symbol next to a pin group name indicate that the pin group is expendable. Click [+] or [-] to expand or collapse a pin group.

Expanded Pin Group

If a pin group is expanded, then the names of its pins are shown bellow the pin group name. The channel number and device pin number corresponding to a pin are shown right to it in the second column. The following columns show the corresponding waveforms (waveform area). They show the states (Low, Midband, High) of the selected pins at the cycles the numbers of which are indicated in the **Cycle** row. The total number of the shown cycles may be 64 at most.

Users can double-click any channel waveform at any cycle to open the **Detailed Information** dialog showing detailed information on that part of the waveform (refer to the Detailed Information Dialog).

Collapsed Pin Group

If a pin group is collapsed, then the corresponding hex values of **Exp Hi**, **Exp Low** (for each time edge), as well as **Act Hi** and **Act Low** (for each period of steady actual value) are shown in the waveform area. The expected and actual values are shown in blue and black correspondingly, in case of no fail, and both in red, in case of occurred fail.

Waveform Area Conventional Symbols

The following table shows the conventional symbols (by default colors) used in the waveform area:

Table 27. Conventional symbols used in the waveform area of the **LATool** window.

Symbol		Indicates
No Fail	**Fail**	
(green)	(red)	Expect Hi
(green)	(red)	Expect Low
(green)	(red)	Expect Midband
(green)	(red)	Expect Valid
(green)	(red)	Open Window
(blue)	(red)	Programmed level
(blue)	(red)	Programmed "don't care" or undefined level
(black)	(red)	Actual measured level
(black)		Level not measured yet
(green)	(green)	Base line

Additional Information

The rows at the bottom of the waveform area show the values of the following three variables at the beginning of each cycle:

- **Time (nS)**

  - time in terms of nS

- **TSet**

  - the number of the used timing set

- **Cycle**

  - the cycle number.

In addition to it the following values are shown in the lower left corner of the window:

- **Sample**

  - n/**m**, where **n** is the number of the samples already obtained during the ongoing measurements, and **m** is the number of the samples to be obtained within the cycles of maximum duration (i.e. the number of the samples actually obtained within the shorter cycles will be less than **m**).

- **Resolution (pS)**

  - the time interval between the two obtained sequential samples in terms of pS.

- **Time Scale**

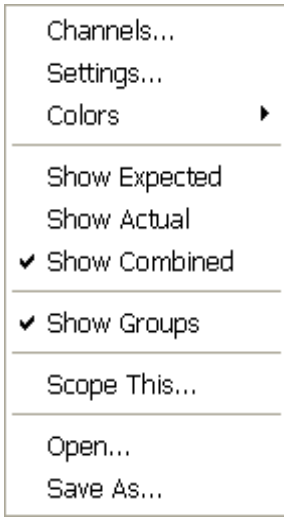
  - a conventional time scale factor (refer to the Settings dialog).

- **Time (nS)**

  - the time corresponding to the current position of the mouse cursor in the waveform area in terms of nS.

LATool Window Context Menu

The **LATool** window provides the following context menu:



Displays the Channels dialog to select the desired channels.
Displays the Settings dialog to set the precision and the waveform area scale.
Settings of the colors.

Shows only the expected states if checked.
Shows only the actual states if checked.
Shows both the expected and actual states.

Shows/hides the hex values of states of the groups.

Turns to the DSTool window for accurate measurement.

Displays the **Open** dialog box to choose and open the desired **.lat** file.
Displays the Save As dialog box to save the current data as a .lat file.

The **Save As** dialog contains the **Save detailed info** check-box, which is checked by default. It allows the user to include or omit the data for the Detailed Information dialog (see the Detailed Information Dialog).

Click **Reset** to reset the default colors used in the LATool window.

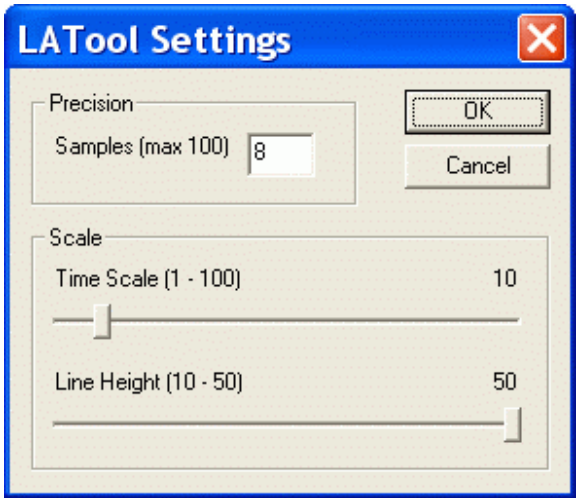
Click any other item to change its current color using the displayed **Color** dialog.

The **Focus** color is the color of the rectangle framing the focused signal to which the data shown in the currently displayed **Detailed Information** dialog refer (refer to the Detailed Information Dialog).

The dialog window in Figure 177 allows users to define the following settings:

Samples (max 100)	Number of the samples to be obtained within the cycles of maximum duration.
Time Scale (1-100)	Time scale factor; increase or decrease this value to expand or shrink the waveform area horizontally.
Line Height (10-50)	Line height scale factor; increase or decrease this value to expand or shrink the waveform area vertically.

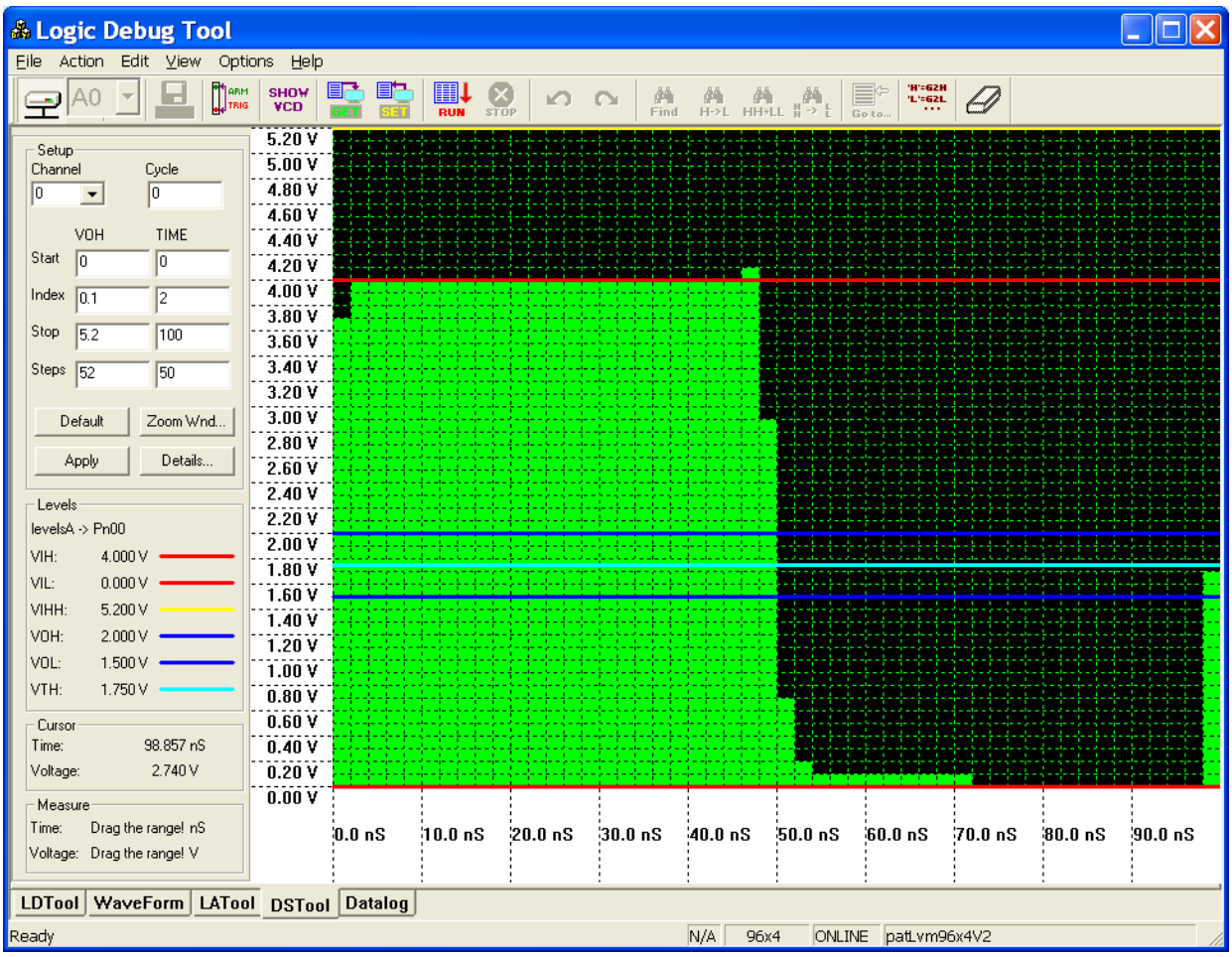
Figure 177. Settings Dialog



DSTool window

DSTool window allows the user to perform accurate voltage measurement on any channel during any cycle and provides detailed view of the result.

Figure 178. DSTool Window



Setup Group

Select or type the desired channel number in the **Channel** combo box and the cycle number in the **Cycle** edit box.

If the LATool window is opened, you can right-click the cycle of the channel you are interested in and choose the **Scope This** command from its context menu. In this case **LDTool** turns to the **DSTool** window with the corresponding numbers for the channel and cycle already set.

Define the following values for **VOH** and **TIME**:

Start	Values of **VOH** and **TIME** from which the measurement should start.
Index	Increment of **VOH** and **TIME** between two sequential measurements.
Stop	**VOH** and **TIME** at which the measurement should stop.
Steps	Numbers of measurements to be done beginning from **Start** values up to the **Stop** values.

Click the **Default** button to set the following default values for the selected channel:

- the start value of **VOH** equal to **VIL**;
- the stop value of **VOH** equal to highest of **VIH** or **VIHH**;
- the start time equal to 0;
- the stop time equal to the duration of the selected cycle.

Click the **Zoom Wnd** button (the mouse cursor turns to "**+**") and drag the mouse cursor over the desired area of the plot to zoom and fit it to the whole plot area.

Click the **Details** button to open the **Detailed Information** dialog ().

Levels Group

This group indicates the LEVELS KTL statement, which is used for the selected pin, the voltage values defined in that statement, as well as the conventional color of each level used in the voltage plot.

Cursor Group

This group indicates the **Time** and **Voltage** values corresponding to the current position of the mouse cursor.

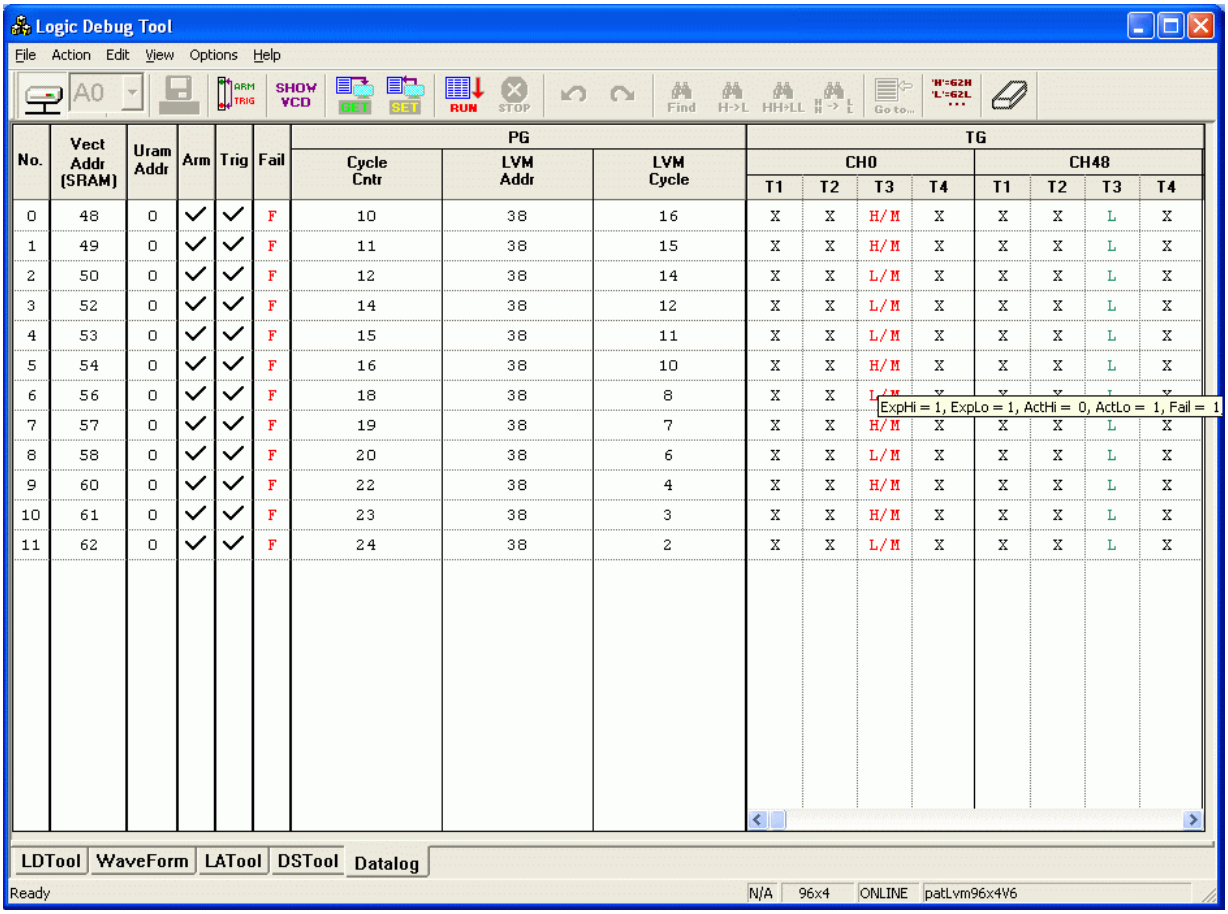
Measure Group

This group indicates the **Time** and **Voltage** ranges corresponding to the space you have dragged the mouse from one point to another in the plot area. Thus, the DSTool window allows the user to measure the time and voltage intervals between any two points of the plot.

Datalog Window

The Datalog window allows the user to view the data stored in History RAM.

Figure 179. Datalog Window



No.	Vect Addr (SRAM)	Uram Addr	Arm	Trig	Fail	PG Cycle Cntr	PG LVM Addr	PG LVM Cycle	TG CH0 T1	TG CH0 T2	TG CH0 T3	TG CH0 T4	TG CH48 T1	TG CH48 T2	TG CH48 T3	TG CH48 T4
0	48	0	✓	✓	F	10	38	16	X	X	H/M	X	X	X	L	X
1	49	0	✓	✓	F	11	38	15	X	X	H/M	X	X	X	L	X
2	50	0	✓	✓	F	12	38	14	X	X	L/M	X	X	X	L	X
3	52	0	✓	✓	F	14	38	12	X	X	L/M	X	X	X	L	X
4	53	0	✓	✓	F	15	38	11	X	X	L/M	X	X	X	L	X
5	54	0	✓	✓	F	16	38	10	X	X	H/M	X	X	X	L	X
6	56	0	✓	✓	F	18	38	8	X	X	L/M	X				
7	57	0	✓	✓	F	19	38	7	X	X	H/M	X	X	X	L	X
8	58	0	✓	✓	F	20	38	6	X	X	L/M	X	X	X	L	X
9	60	0	✓	✓	F	22	38	4	X	X	H/M	X	X	X	L	X
10	61	0	✓	✓	F	23	38	3	X	X	H/M	X	X	X	L	X
11	62	0	✓	✓	F	24	38	2	X	X	L/M	X	X	X	L	X

The first five columns show the following data:

No.	Cycle number
Vector Addr (SRAM)	Vector's address in SRAM
Uram Addr	URAM Address
Arm	Arm state (a check mark indicates arm occurred on that URAM)

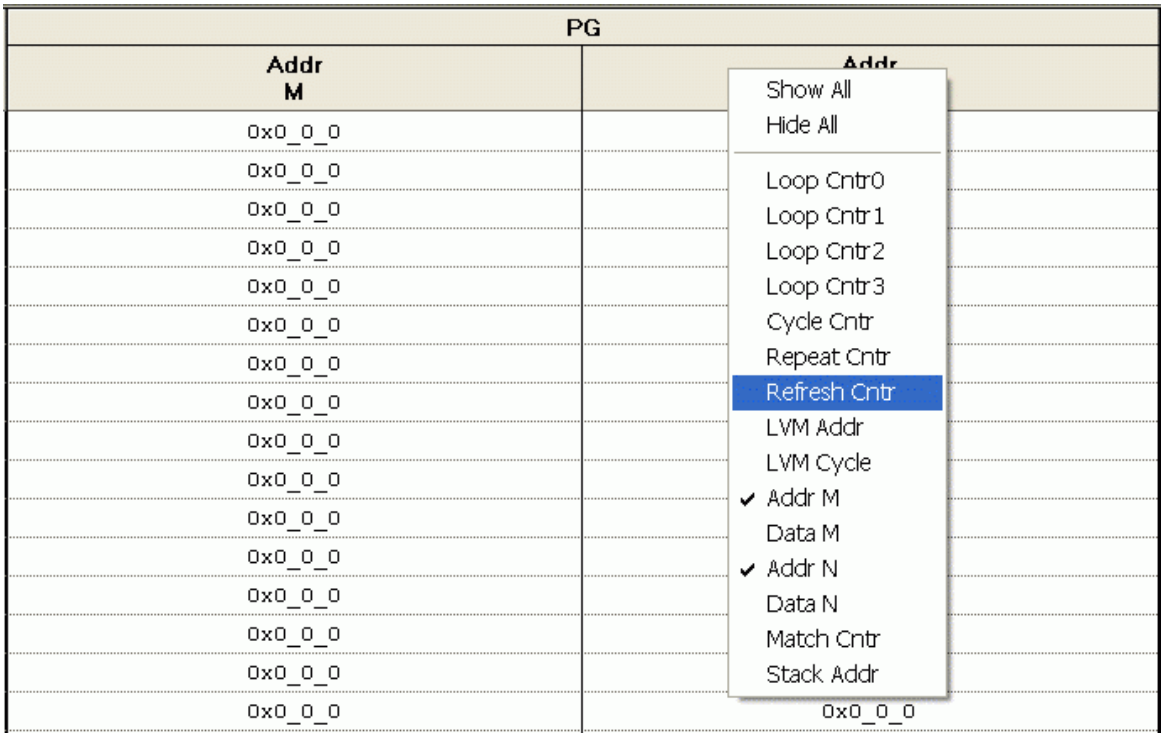
Trig	Trigger state (a check mark indicates trigger occurred on that URAM)
Fail	Pass/Fail (red “**F**” indicates “Fail”; empty cell means “Pass”)

The **PG** and **TG** fields allow the user to view the PG/TG data ().

Right-click the top part of the **PG** field to open its context menu and select the desired resource to display the column of its values.

Selection of resources to be displayed are shown in Figure 180:

Figure 180. Resource Selection



Users can also **Show All** or **Hide All** resources at once.

Each cell of the **PG** field is provided with context menu allowing selection of radix in Figure 181.

Figure 181. Selection of Radix

PG	
Addr M	Addr N
0x0_0_0	0x0_0_0
0x0_0_0	0x0_0_0
0x0_0_0	0x0_0_0
0x0_0_0	0x0_0_0
0x0_0_0	0x0_0_0
0x0_0_0	0x0_0_0
0x0_0_0	0x0_0_0
0x0_0_0	0x0_0_0
0x0_0_0	0x0_0_0
0x0_0_0	0x0_0_0
0x0_0_0	0x0_0_0
0x0_0_0	0x0_0_0
0x0_0_0	0x0_0_0
0x0_0_0	0x0_0_0
0x0_0_0	0x0_0_0

The **TG** field also allows the user to view data by channels (Figure 182) or by pins (Figure 183).

Figure 182. Data by Channels

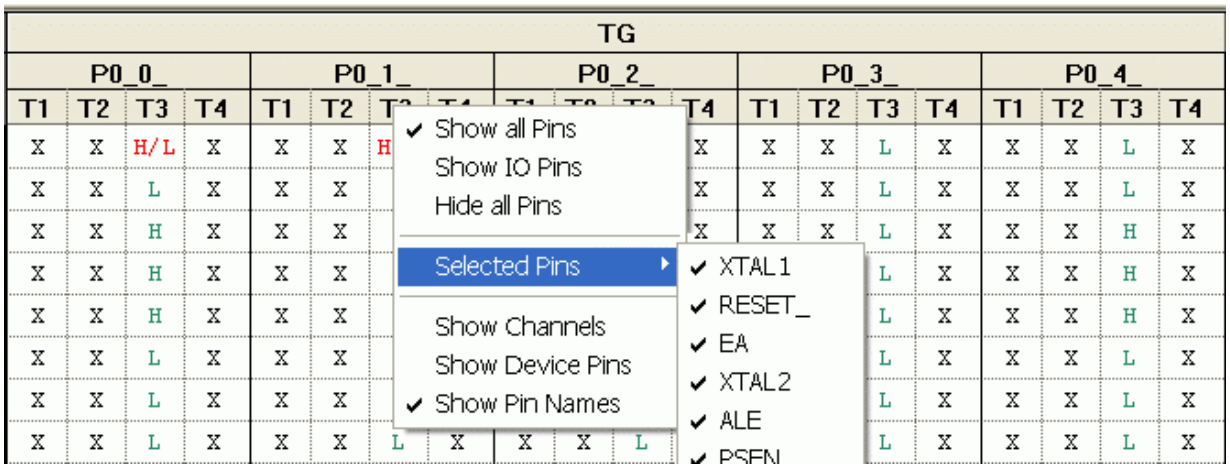
TG																			
CH1				CH5				CH3				CH7				CH9			
T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
X	X	H/L	X	X	X	H/L	X	X	X	L	X	X	X	L	X	X	X	L	X
X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X
X	X	H	X	X	X	L	X	X	X	H	X	X	X	L	X	X	X	H	X
X	X	H	X	X	X	L	X	X	X	H	X	X	X	L	X	X	X	H	X
X	X	H	X	X	X	L	X	X	X	H	X	X	X	L	X	X	X	H	X
X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X

Figure 183. Data by Device Pins

TG																			
P0_0_				P0_1_				P0_2_				P0_3_				P0_4_			
T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
X	X	H/L	X	X	X	H/L	X	X	X	L	X	X	X	L	X	X	X	L	X
X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X
X	X	H	X	X	X	L	X	X	X	H	X	X	X	L	X	X	X	H	X
X	X	H	X	X	X	L	X	X	X	H	X	X	X	L	X	X	X	H	X
X	X	H	X	X	X	L	X	X	X	H	X	X	X	L	X	X	X	H	X
X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X

Right-click the top part of the **TG** field to open its context menu (Figure 184).

Figure 184. TG Field Context Menu



Users can **Show all Pins**, **Show IO Pins** only, or **Hide all Pins**.

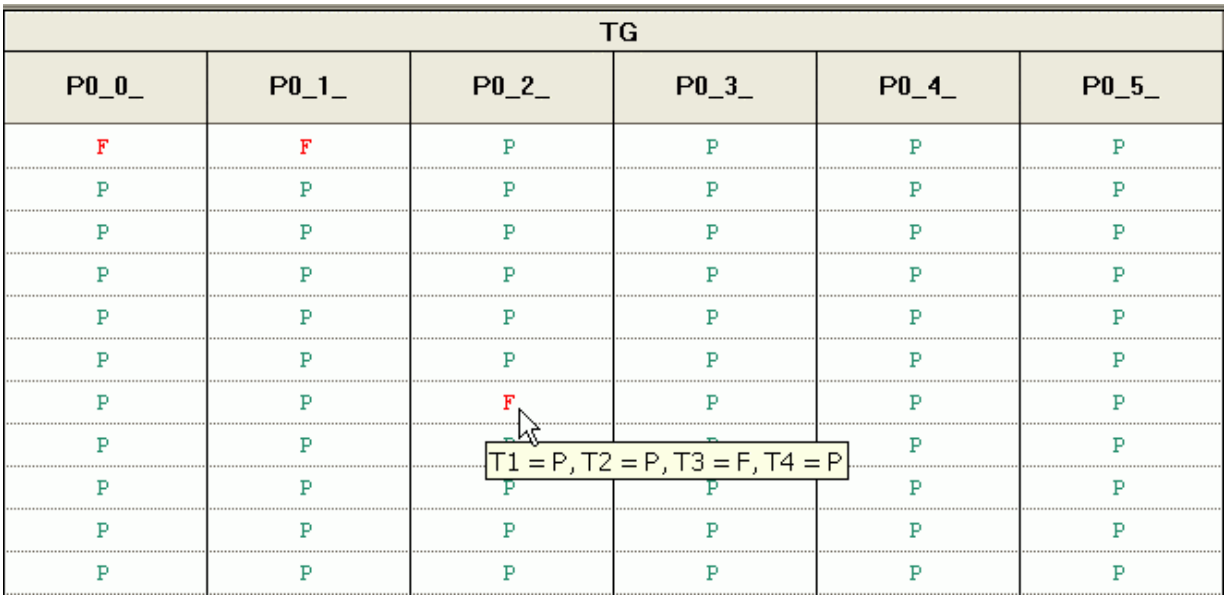
Point to the **Selected Pins** (Figure 185) and select the desired pins from the pop-up menu to display the columns of their states. The selected pins are marked with check marks.

Select **Show Channels** to view the states by channels or select **Show Device Pins** to view them by pins. Select also **Show Pin Names** to view the corresponding names.

Two modes are available for showing the states of channels/pins: **Brief** and **Detail**.

In **Brief** mode the cells of the **TG** field show only Pass (“**P**”) and Fail (“**F**”) states (see Figure 185).

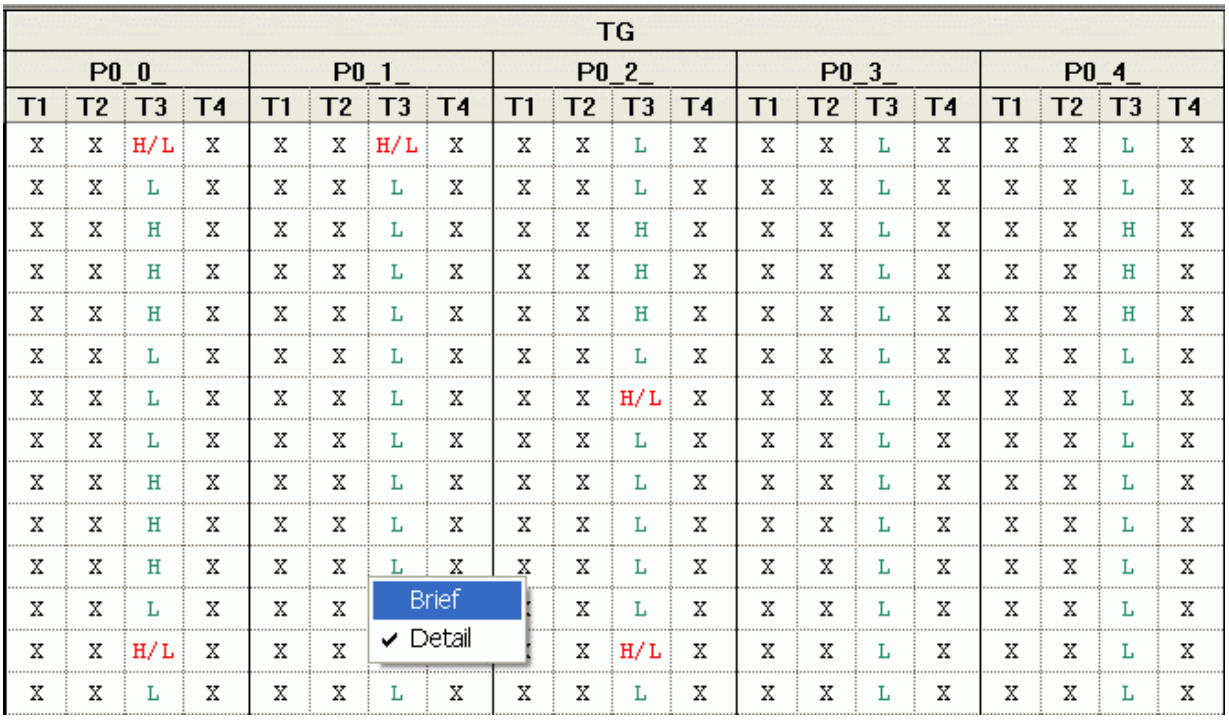
Figure 185. Brief Mode



User can point to any cell of the **TG** field and see the corresponding states at **T1**, **T2**, **T3** and **T4** in a pop-up tip.

Right-click any cell and select **Detail** from its context menu to turn the **TG** field to **Detail** mode (Figure 186).

Figure 186. Detail Mode



TG																			
P0_0_				P0_1_				P0_2_				P0_3_				P0_4_			
T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
X	X	H/L	X	X	X	H/L	X	X	X	L	X	X	X	L	X	X	X	L	X
X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X
X	X	H	X	X	X	L	X	X	X	H	X	X	X	L	X	X	X	H	X
X	X	H	X	X	X	L	X	X	X	H	X	X	X	L	X	X	X	H	X
X	X	H	X	X	X	L	X	X	X	H	X	X	X	L	X	X	X	H	X
X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X
X	X	L	X	X	X	L	X	X	X	H/L	X	X	X	L	X	X	X	L	X
X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X
X	X	H	X	X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X
X	X	H	X	X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X
X	X	H	X	X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X
X	X	L	X	X	X	Brief		X	X	L	X	X	X	L	X	X	X	L	X
X	X	H/L	X	X	X	✔ Detail		X	X	H/L	X	X	X	L	X	X	X	L	X
X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X	X	X	L	X

In the **Detail** mode **T1**, **T2**, **T3** and **T4** are displayed for each pin, and the cells of the **TG** field show the states according to the mnemonic symbols presented in the last column of Table 28.

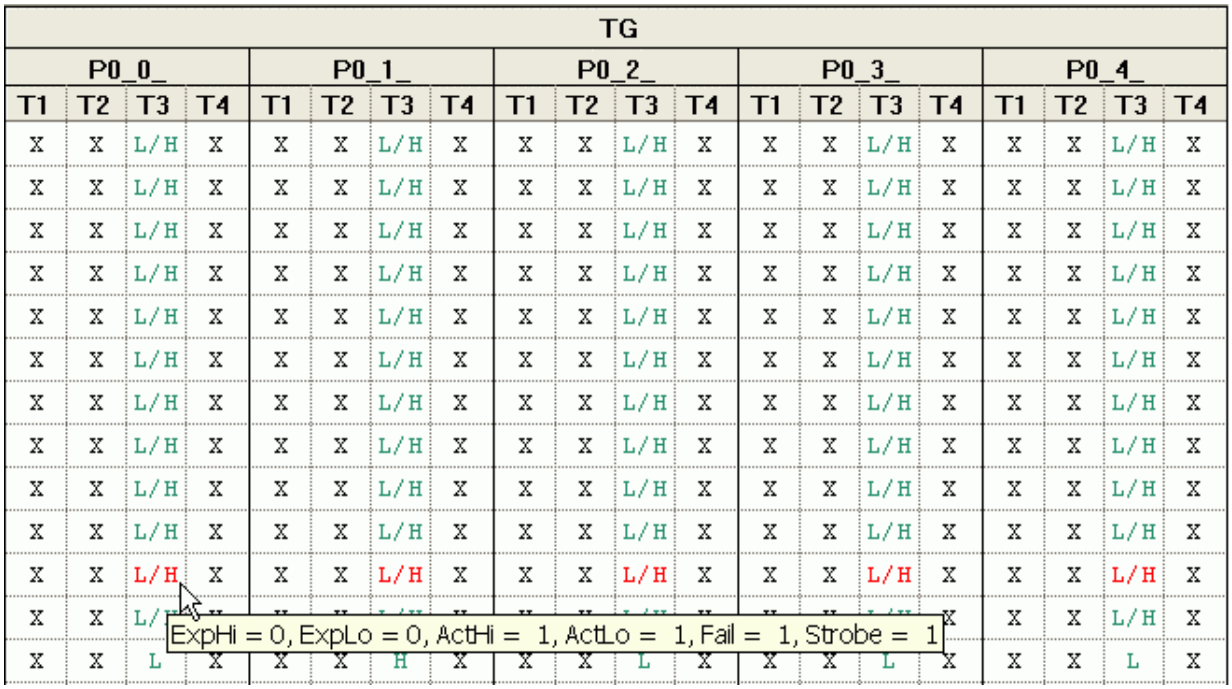
Table 28. Mnemonic for 6-Bit of TG Fail Latch

Expected		Actual		Strobe	Fail	Mnemonic (Exp/Act)
Hi	Lo	Hi	Lo			
X	X	X	X	0	X	X
1	1	1	1	1	0	H
0	1	0	1	1	0	M
0	0	0	0	1	0	L
1	1	0	1	1	1	H/M
1	1	0	0	1	1	H/L
0	1	1	1	1	1	M/H
0	1	0	0	1	1	M/L
0	0	1	1	1	1	L/H
0	0	0	1	1	1	L/M
1	1	1	1	1	1	H/G
0	1	0	1	1	1	M/G
0	0	0	0	1	1	L/G

H – High
L – Low
M – Midband
G – Glitch
X – Don't Care

In the **Detail** mode users can point to any cell of the TG field and see all the six bits of the fail latch (Figure 187).

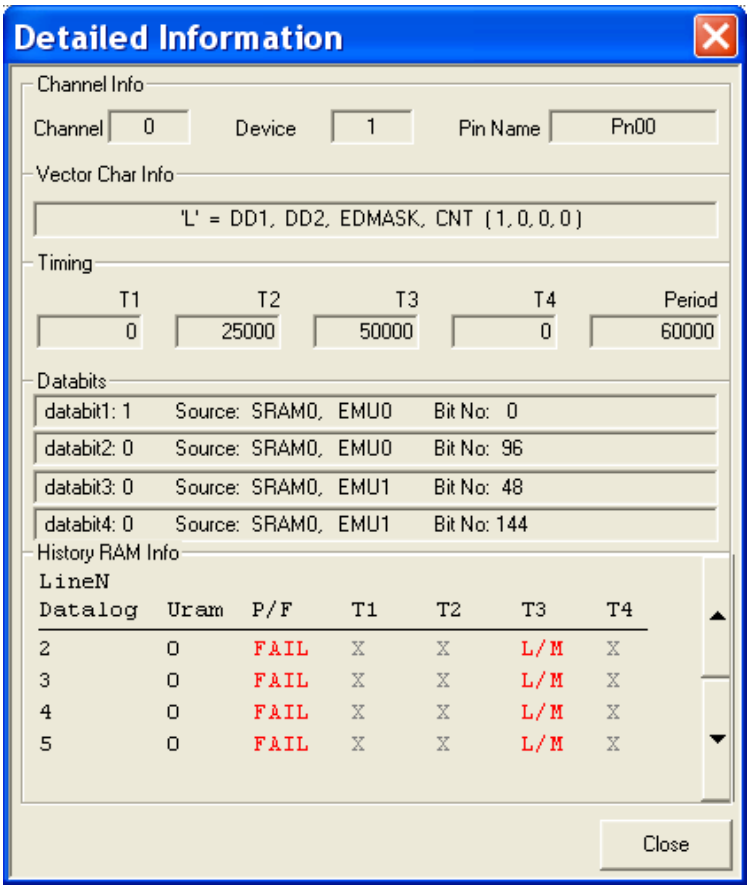
Figure 187. Detail Mode



Detailed Information Dialog

Double-clicking any vector data in the **LDTool** window, any signal in the **WaveForm** or **LATool** window, or the **DSTool** window to open the **Detailed Information** dialog (Figure 188) and view detailed information on the focused vector char or signal, which appears framed by a bold rectangle (green by default) in the **LDTool**, **Waveform** and **LATool**

Figure 188. Detailed Information Dialog


Detailed Information
Channel Info
Channel 0
Device 1
Pin Name Pn00
Vector Char Info
'L' = DD1, DD2, EDMASK, CNT (1,0,0,0)
Timing
T1 T2 T3 T4 Period
0 25000 50000 0 60000
Databits
databit1: 1 Source: SRAM0, EMU0 Bit No: 0
databit2: 0 Source: SRAM0, EMU0 Bit No: 96
databit3: 0 Source: SRAM0, EMU1 Bit No: 48
databit4: 0 Source: SRAM0, EMU1 Bit No: 144
History RAM Info
LineN Datalog Uram P/F T1 T2 T3 T4
2 0 FAIL X X L/M X
3 0 FAIL X X L/M X
4 0 FAIL X X L/M X
5 0 FAIL X X L/M X
Close

Toolbar of LDTool

The toolbar of LDTool, shown in provides the following buttons:

Figure 189. LDTool Toolbar

1. Online/Offline — Switches between online and offline modes.

Offline

Online

2. List of active modules — Allows selection of the active module (figure below).

3. Save — Opens the Save dialog for saving data as a **.vbd** file.

4. Arm and Trigger Conditions — Opens the Arm and Trigger Conditions dialog for setting the arm and trigger conditions.

5. Show VCD — Shows all channels in the **LDTool** and **WaveForm** windows in the same order as defined in the pattern file.

6. Get Vector Data — Reads from SRAM the currently loaded patterns and shows the data in the **LDTool**, **WaveForm** and **LATool** windows.

7. Set Vector Data — Loads the edited data back to SRAM.

8. Run — In the **LDTool** window this button runs the pattern once (sends the input data to the device under test and gets back the output data).

   In the **LATool** window it repeats running cycles incrementing the time by the **Sample Resolution** value starting from zero to the longest period defined in the pattern.

   In the **DSTool** window it repeats running cycles incrementing the **VOH** and **TIME** by the **Index** and within the range defined in the **Setup** group.

9. Stop	Stops pattern running.
10. Undo	Reverses the last edition of any editable data.
11. Redo	Repeats the last reversed edition.
12. Find	Opens the Find dialog allowing the user to find a specified value or vector character in the LDTool window.
13. Find And Replace	Opens the Find And Replace dialog allowing the user to find a specified value or vector character in the LDTool window and replace it with another value or vector character.
14. Find And Replace String	Opens the Find And Replace String dialog allowing the user to find a specified string in the LDTool window along the rows and replace it with another string.
15. Find And Replace Column	Opens the Find And Replace Column dialog allowing the user to find a specified string in the LDTool window along the columns and replace it with another string.
16. Go To	Opens the Go to dialog allowing the user to jump to the desired line or fail in the LDTool window.
17. Show VectorChar Info	Opens the VectorChar Info dialog and shows the vector character definitions.
18. Clear Current window	Clears the data only in the currently opened window if it is the LATool, DSTool, or Datalog window, or in all windows if the LDTool window is opened.

When the user turns to Online mode the **List of active modules**, **Arm and Trigger Conditions**, **Get Vector Data** and **Clear** buttons become active (Online/Offline).

If there is no data in SRAM, then after clicking the **Get Vector Data** button the following message will be displayed: “**Error, no logic pattern loaded!**”. If SRAM contains data, then after **Get Vector Data** the **Save**, **Set Vector Data**, **Run, Find, Find And Replace, Find And Replace String**, **Find And Replace Column**, **Go To** and **Show VectorChar Info** buttons become active, and the **List of Active Modules** button become inactive (see Figure 190).

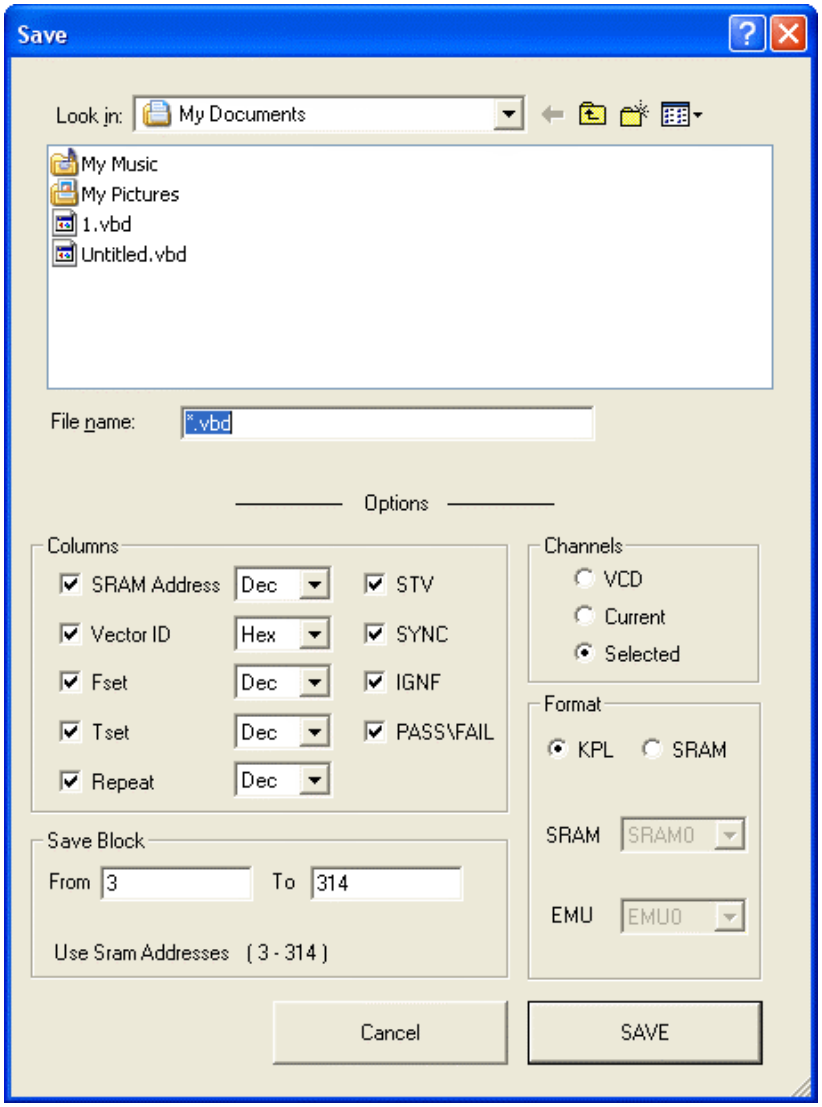
Figure 190. List of Active Modules

To change the active module user must clear the currently loaded data.

Save Dialog

The Save dialog allows users to specify which data of the **LDTool** window is to be saved and save it as a **.vbd** file (Figure 191).

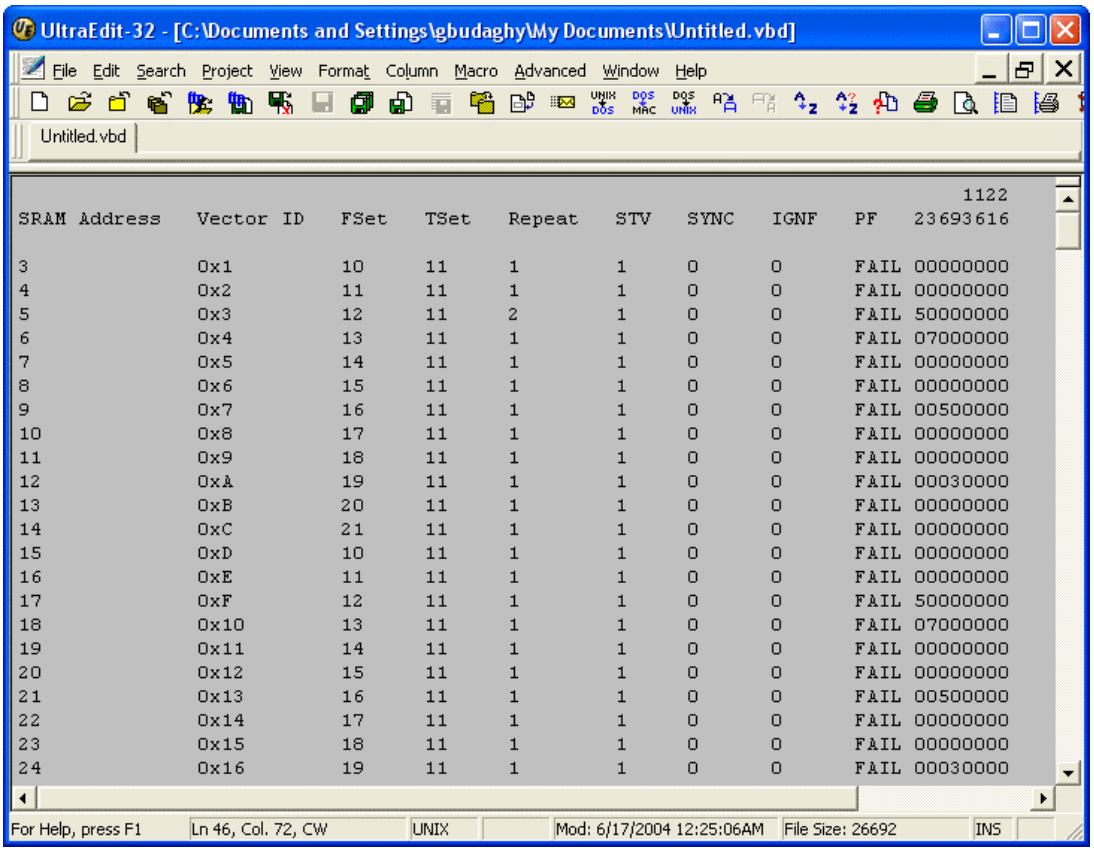
Figure 191. Save Dialog Window



The following describes features of the Save dialog window:

Columns	Check/uncheck the check boxes to select the columns to be saved along with the desired radices (if available).
Sram Address Block	Specify the desired address block by typing the numbers of the first and last addresses of the block in the **From** and **To** edit boxes correspondingly. The whole available address range is indicated below (**Use Sram Addresses**).
Channels	**VCD** – saves all channels in the same order as in the pattern file. **Current** – saves the channels currently shown in the **LDTool** window. **Selected** – saves only the selected channels.
Format	**KPL** – saves the data in KPL format (see Figure 192). **SRAM** – saves the data as stored in SRAM. The **SRAM** and **EMU** combo boxes bellow are active if **SRAM** is selected. **SRAM** - allows the user to save the content of the selected **SRAM**. **EMU** - allows the user to save the content of the selected **EMU**.

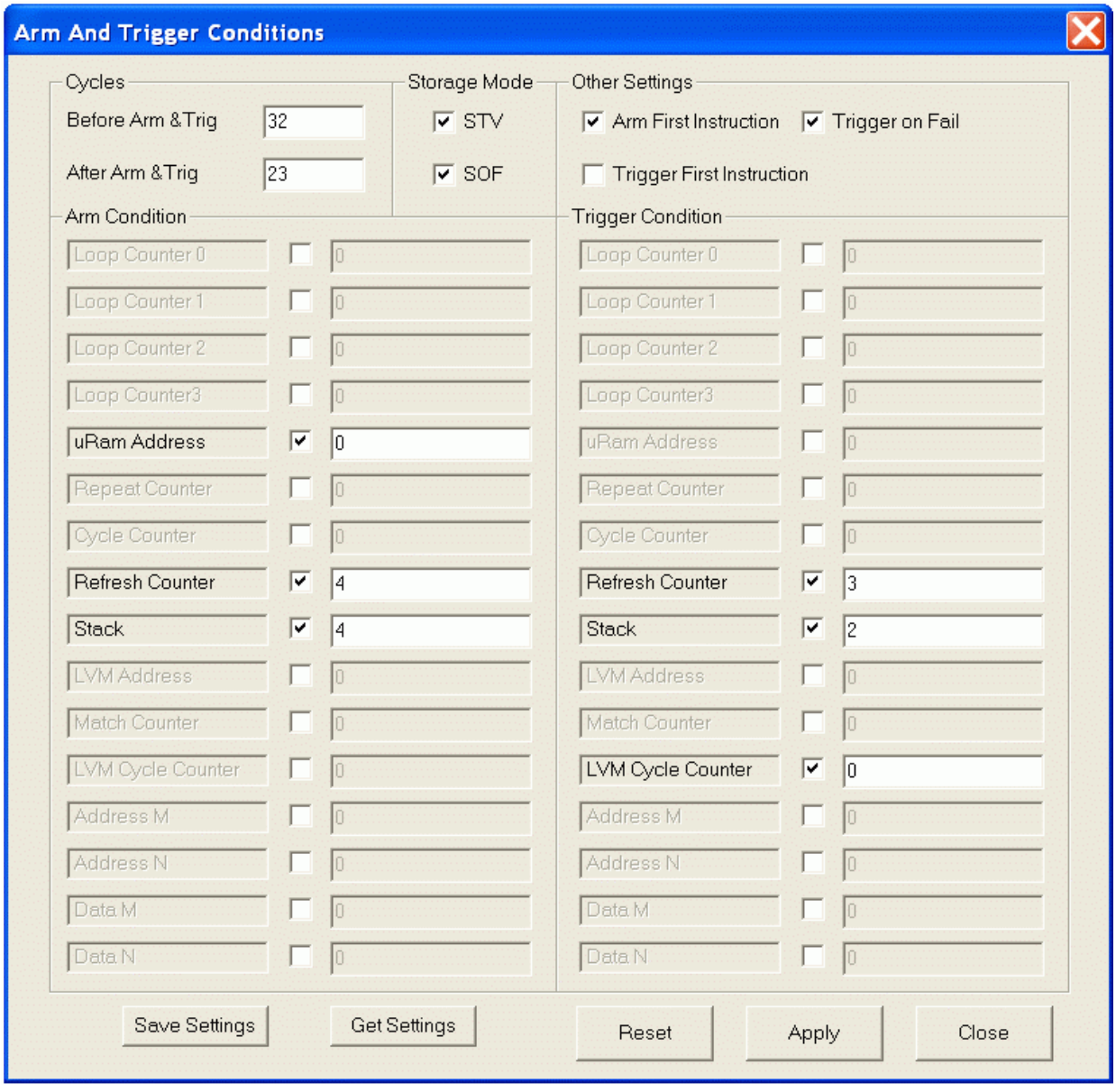
Figure 192. Save Format



The *Arm and Trigger Conditions*

The Arm and Trigger Conditions window allows the user to set arm and trigger conditions and other related settings. (See Figure 193)

Figure 193. Arm and Trigger Conditions Window



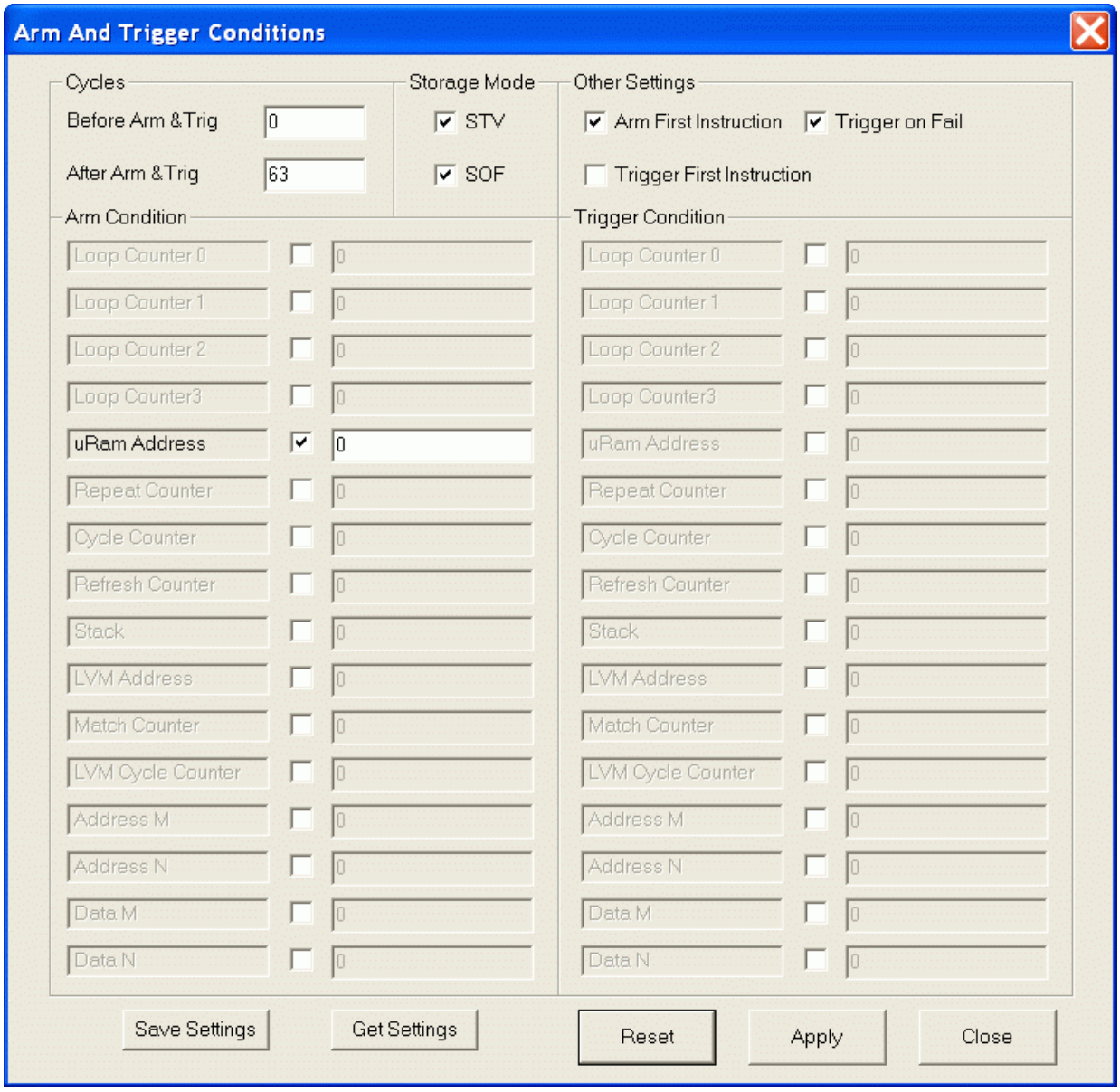
Cycles	The **Before Arm & Trig** edit box allows the user to specify the number of cycles to be passed before arm and trigger event. The **After Arm & Trig** edit box allows the user to specify the number of cycles to be passed after arm and trigger event. This number can be at most 63. The sum of these two numbers can be at most 64.
Storage Mode	The **STV** (Store This Vector) and **SOF** (Store Only Fail) checkboxes allow selection of **STV** or **SOF** mode.
Other Settings	**Arm First Instruction** – if checked LDTool starts data storing in History RAM at the first instruction of the pattern. **Trigger First Instruction** – if checked LDTool passes after the first instruction as many cycles as specified in the **After Arm & Trig** edit box and then stops storing. **Trigger ON FAIL** – if checked LDTool passes after the first occurred fail as many cycles as specified in the **After Arm & Trig** edit box and then stops storing.

The **Arm Condition** and **Trigger Condition** fields contain arm/trigger conditions. Definition of each condition is presented by the following boxes:

Resource Box	Contains the name of the resource to be conditioned.
Check Box	Check/uncheck for enable/disable the defined condition.
Edit Box	Allows users to specify the value of the selected resource to be Matched during the test for generating arm/trigger event.

Users can save the current settings by clicking the **Save Settings** button and then restore them by clicking the **Get Settings** button. The **Reset** button resets the settings as shown in Figure 194.

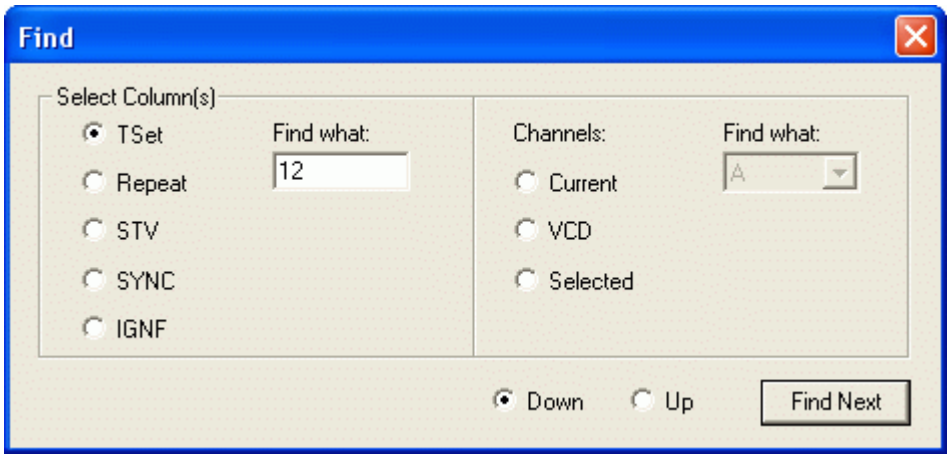
Figure 194. Set, Get, Reset Buttons



Find Dialog

This modeless dialog allows the user to find a value or vector character in the **LDTool** window. See Figure 195.

Figure 195. Find Dialog



In case of searching a value user should select the desired column by clicking one of the **TSet**, **Repeat**, **STV**, **SYNC**, **IGNF** radiobuttons and specify in the **Find what** edit box the value to be looked for in that column.

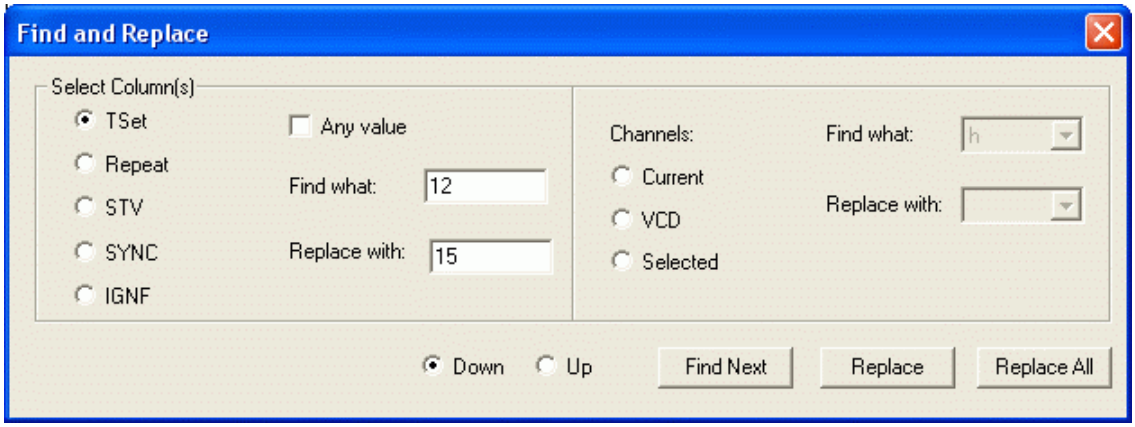
In case of searching a vector character user should select the desired range of channels (**Current**, **VCD**, **Selected**) and choose the vector character to be looked for from the **Find what** combo box.

To find the next or previous occurrence of the specified value/vectorchar starting from the first cell of the channel(s) selected in the LDTool window user should select the **Down** or **Up** radiobutton and click **Find Next**. The currently found occurrence appears in the **LDTool** window in gray background

Find And Replace Dialog

This modeless dialog allows the user to find a value or vector character in the **LDTool** window and replace it with another value or vector character. See Figure 196.

Figure 196. Find And Replace Dialog



This dialog provides the same finding options as in the **Find** dialog, besides the additional **Any value** check box, which allows replacement of any value with the value specified in the **Replace with** edit box beginning from the selected line in the **LDTool** window.

In case of finding and replacing a vector character the **Replace with** combo box offers the user to choose only among those vector characters, with which the vector character selected in the **Find what** combo box can be replaced.

Click **Find Next** to find the next occurrence of the value (vector character) specified in the Find what box (combo box) and then stop.

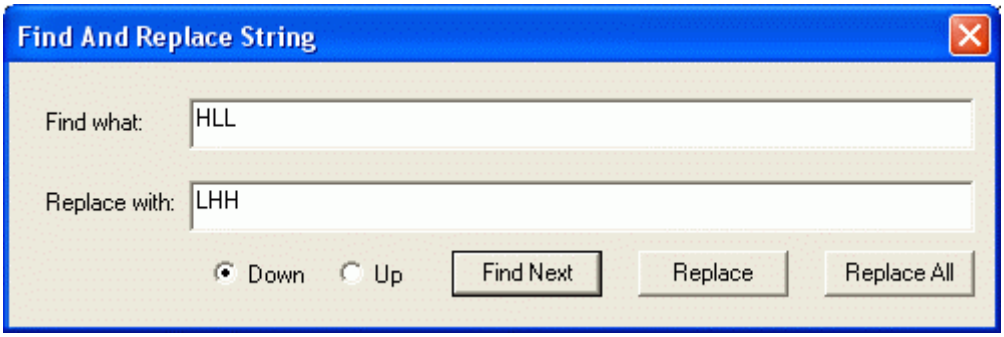
Click **Replace** to replace the found occurrence with the value (vector character) specified in the **Replace with** box (combo box) and then stop.

Click **Replace All** to replace automatically all occurrences of the search criteria in the **LDTool** window. In this case a message appears and shows the total number of the occurred replacements.

Find And Replace String Dialog

This modeless dialog allows the user to search and find a string of vector characters along the lines of the **LDTool** window and replace it with another string. See Figure 197.

Figure 197. Find And Replace String Dialog

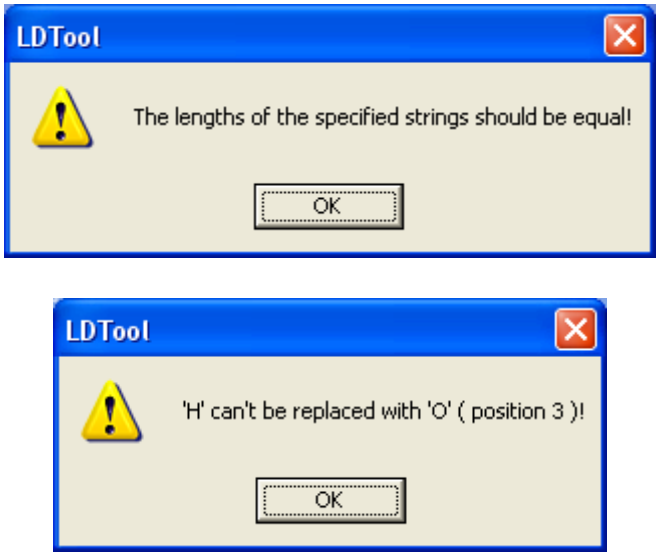


The search and replacement go on forward (if **Down** is selected) or backward (if **Up** is selected) along the lines of the **LDTool** window, starting from the selected line. If no line is selected, then it starts from the first line.

The user-specified strings in the **Find what** and the **Replace with** edit boxes should be of the same length. Otherwise, a warning message will appear about the unequal lengths of the specified strings.

If any vector char of the string specified in the **Find what** edit box is not replaceable with corresponding vector char of the string specified in the **Replace with** edit box, then a warning message appears about the impossible replacement (see Figure 198).

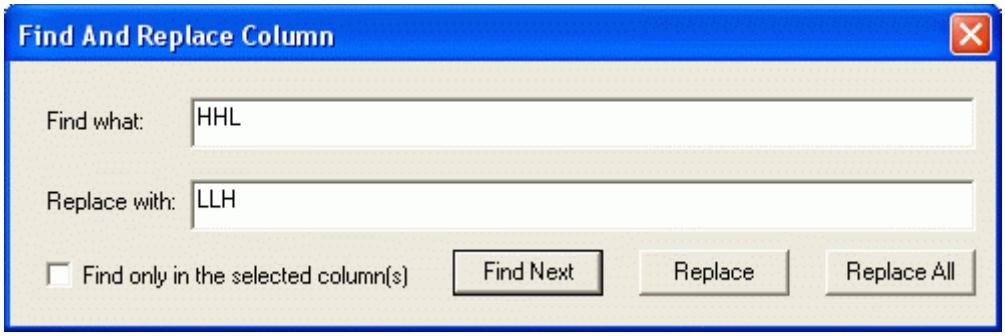
Figure 198. Find Warning Messages



Find And Replace Column Dialog

This modeless dialog allows the user to search and find a string of vector characters along the columns of the **LDTool** window and replace it with another string (see Figure 199).

Figure 199. Find And Replace Column Dialog



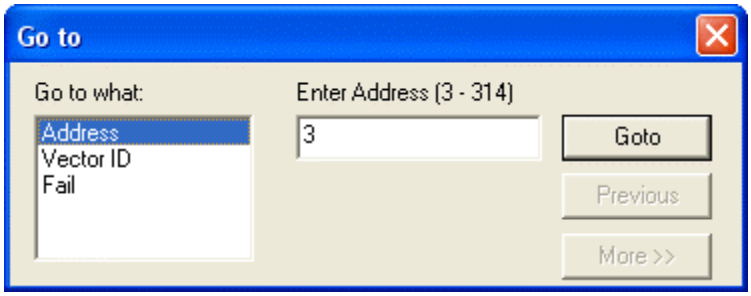
The search and replacement go on down (if **Down** is selected) or up (if **Up** is selected) along the columns of the **LDTool** window, starting from the first selected column. If no column is selected, then it starts from the first column.

User can check the **Find only in the selected column(s)** check box to cover only the selected column(s).

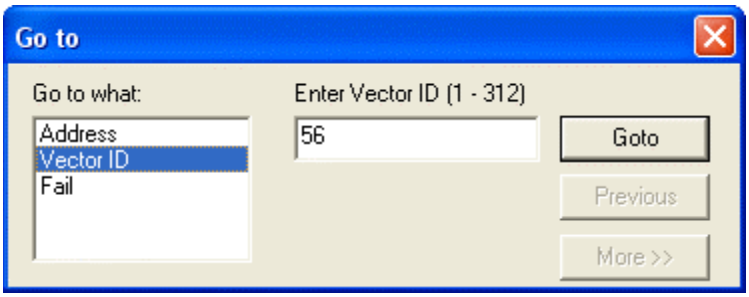
Go to Dialog

This modeless dialog allows the user to jump to the desired **Address**, **Vector ID** or **Fails** (see Figure 200).

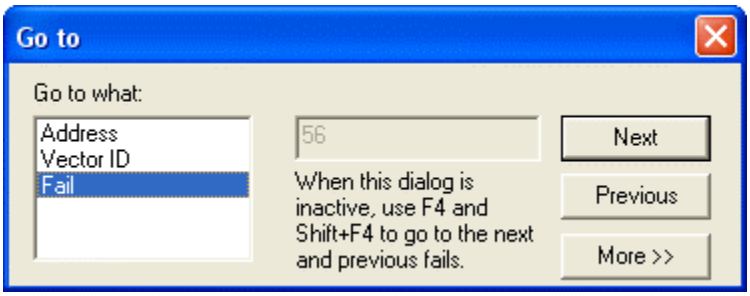
Figure 200. Go To Dialog



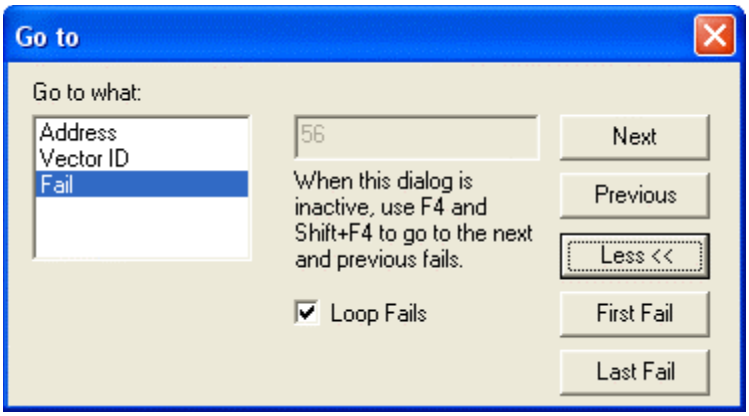
If **Address** is selected in the **Go to what** list, then you can specify the desired address in the **Enter Address** edit box and click **Goto** to jump to it.



If **Vector ID** is selected in the **Go to what** list, then you can specify the desired Vector ID in the **Enter Vector ID** edit box and click **Goto** to jump to it.



For more options click the **More** button () to display additional options for advanced fail survey.
Loop Fails: if checked allows looping back to the first (last) fail upon reaching the last (first) fail while stepping through the fixed fails.
First Fail: jumps to the first fail.
Last Fail: jumps to the last fail.

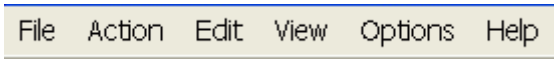


If **Fail** is selected in the **Go to what** list, then the **Goto** button turns to **Next** button. If any fail is fixed, the **Next** and **Previous** buttons will become active. Use these buttons to jump to the next or previous address with fixed fail.

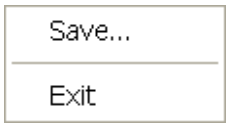
In all cases the **LDTool** window scrolls and brings the address with the fixed fail to its top.

LDTool Menu

LDTool provides the following menu:



File menu items:



Saves the data of the LDTool window to a .vbd file through the Save dialog.

Ends the current LDTool session.

Action menu items:

Switches between online and offline modes.

Reads from SRAM and shows the currently loaded patterns.

Loads the edited data back to SRAM.

Starts pattern running.

Stops pattern running.

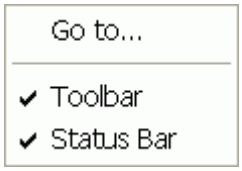
Clears the data in the LDTool and Datalog windows.

Edit menu items:

Reverses the last edition of any editable data.

Repeats the last reversed edition.

View menu items:

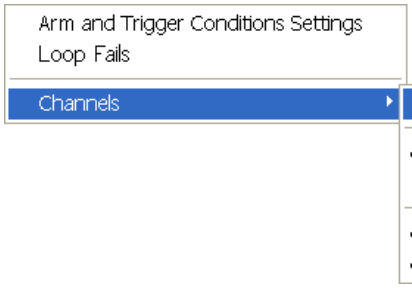


Opens the **Go to** dialog to jump to the desired address/fail in the **LDTool** window

Shows/hides the toolbar

Shows/hides the status bar

Options menu items:



Opens the Arm and Trigger Conditions dialog.

Loops to the first (last) fail upon reaching the last (first) fail

Opens the Channels dialog

Shows vector data by channels

Shows vector data by pins

Shows/hides names

Shows/hides fail summary

Help menu item:

Displays the copyright notice and version number of your copy of LDTool.

DBM Editor (DBMEDIT)

The Data Buffer Memory (DBM) Editor utility is a viewer, generator and modifier of DBM Patterns. These Patterns can be read from a *.dbi (DBM binary extension) file or directly from the Kalos 2 SRAM hardware (requires Get support). Also the output of the utility generates a *.dbi or sends output directly to the SRAM hardware (requires Set support). Operations include Online (getting, setting, and modifying Online DBM Patterns) and Offline (*.dbi saved during operations) interactions. This also allows online or .dbi data to be translated into *.hex files.

Multiple operations are available but single operation selection is under control of property page selections. Four property page operations are available: DBM Editor, Socket File, DBM View and Overrides, and Hex (ASCII) Format.

The DBMEdit application utility allows the user to select a fixed or defined format for the graphical table views—Kalos defined and/or user defined.

The DBMEdit utility is launched by clicking on the DBMEdit icon (see Figure 201) or it can be selected (launched) from the Utilities menu item.

Figure 201. DBMEdit Icon

Primary Window

The following is a general description of the primary DBM Editor window.

File Menu and Toolbar Options

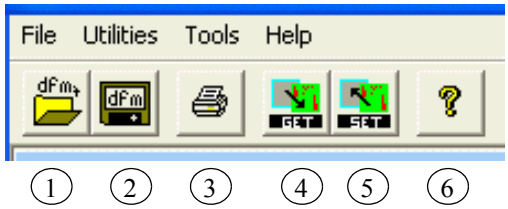
DBM File menu pulldown options and the toolbar options (see Figure 202) are described below.

Import*.dbi	Allows importing of a *.dbi file, originally exported for this application, and re-configures to the input buffer data.
Export*.dbi	Allows exporting of a *.dbi file with the current application status and conditions.

Get DBM Data (HW)	Get current DBM data from the specified Kalos slice and its respective hardware.
Set DBM Data (HW)	Send to the specified Kalos SRAM hardware. Note: if in Simulation Mode, data has a maximum length of 256K.
Print...	Print allows the user to schedule a print hardcopy operation for the selected DBM pattern.
Print Preview	Allows reviewing of the data before the Print operation is invoked.
Print Setup...	Setups, formatting, and path control for the Print operation.
Exit	Closes the DBM Editor utility and all associated windows.

The toolbar is an arrangement of graphical buttons (clustered by functional groups) that when clicked send messages, as do menus and keyboard accelerators, for requested functions of the DBMEdit utility (see Figure 202).

Figure 202. Toolbar



1. Import*.dbi - (same as the above File menu definition).
2. Export*.dbi - (same as the above File menu definition).
3. Print - (same as the above File menu definition).
4. Get DBM Data (HW) - (same as the above File menu definition).
5. Set DBM Data (HW) - (same as the above File menu definition).
6. About - displays software version information.

Property Pages

DBMEdit has four property pages: DBM Editor, Socket File, DBM View & Overrides, and Hex (ASCII) Format. Select the desired property page view by mouse clicking on the property page tab. Some of these views may be toggled between different formats by clicking the *View Selections* button where applicable. The following describes the functions of each DBMEdit property page.

DBM Editor

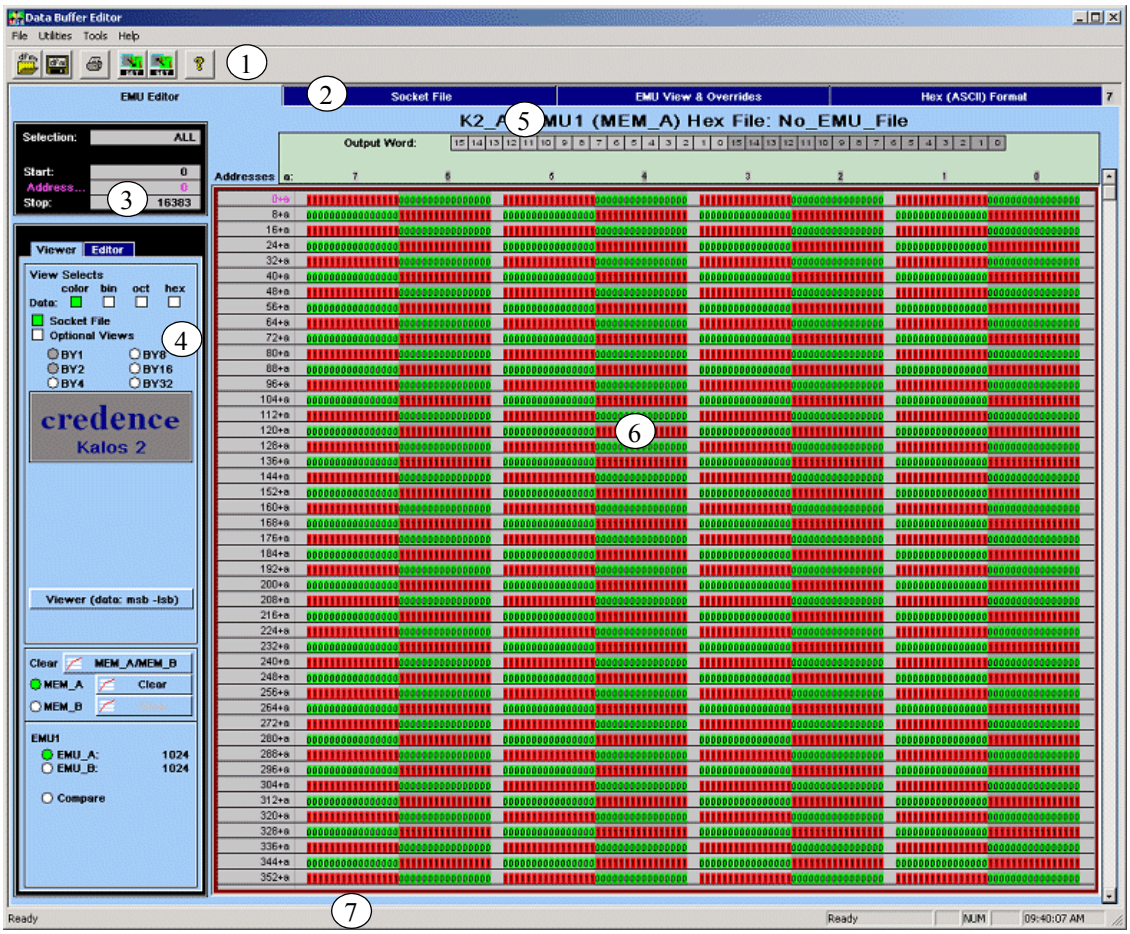
The top-level window of DBMEdit is sub-divided into multiple view or control areas (see Figure 203). The following describes each area:

1. Menu bar and toolbar - interface for selecting operations of the application.
2. Property page (tab) selection.
3. Pattern, DBM segments and list view pointers selections.
4. Control selection buttons and text field entries - current edit operations.
5. Format header - selected titles and data from selected formats.
6. Draw area - scroll view of the selected DBM pattern and/or segment.
7. Application message line and status bars

Viewer

The data buffer Viewer option shows online DBM patterns or offline DBM files using multiple formatting graphical displays; Kalos defined and/or user defined.

Figure 203. DBM Editor (Viewer) Primary Window



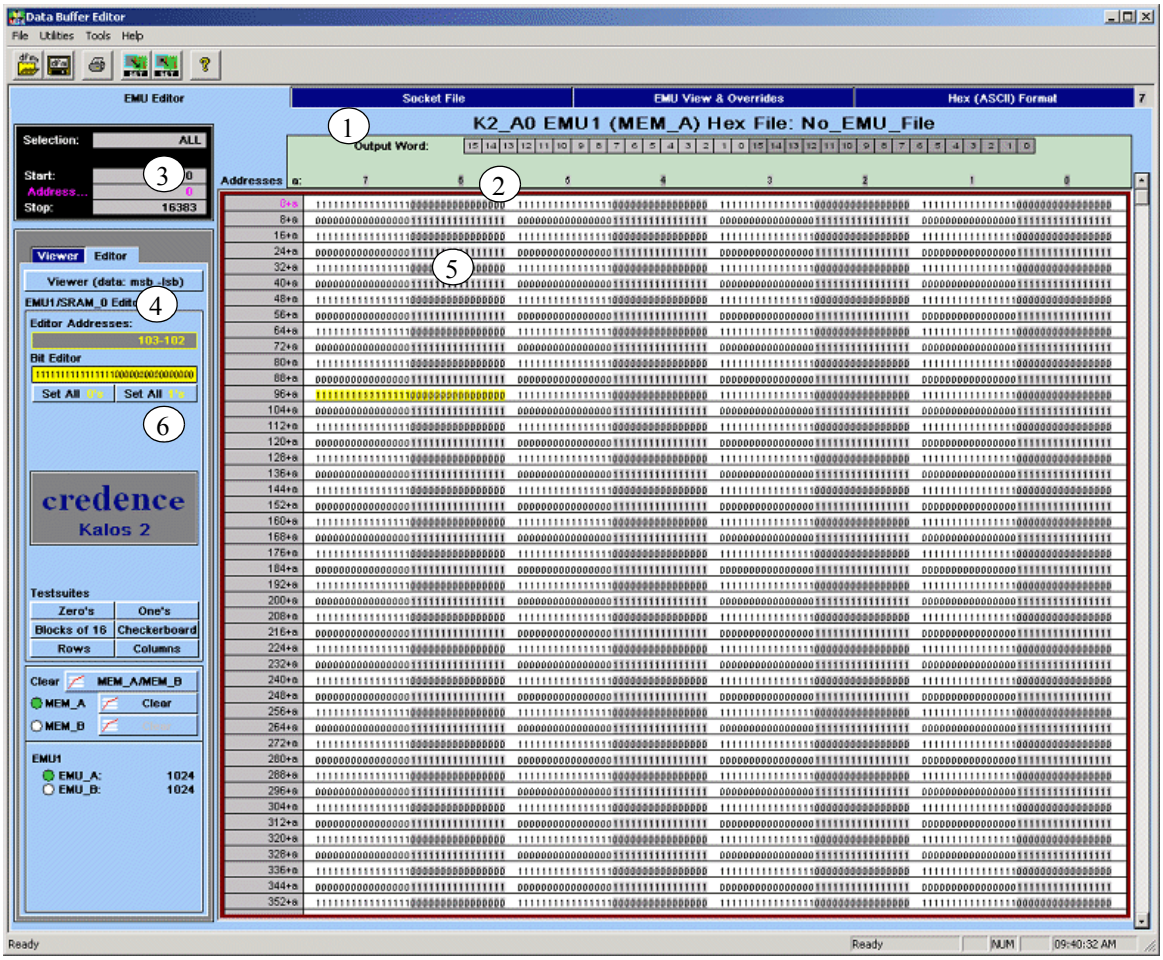
Editor

DBMEdit Editor allows the user to perform basic table editing operations to modify columns and rows. The following describes the six areas of focus on this property page (see Figure 204).

1. DBM header titles using the formats from the DBM Viewer selections. Changing formats does not destroy the current DBM data, it changes only the way the data is presented to the user.
2. Column bit selection (yellow highlight) for vertical editing.
3. Pattern list selector and text field pointer for selecting the segment and/or start point of the segment for viewing.
4. Specified address range for row editing.

5. Current selected address view and a DBM (highlighted) for row editing.
6. Control area for editing operations.

Figure 204. DBM Editor



Socket File

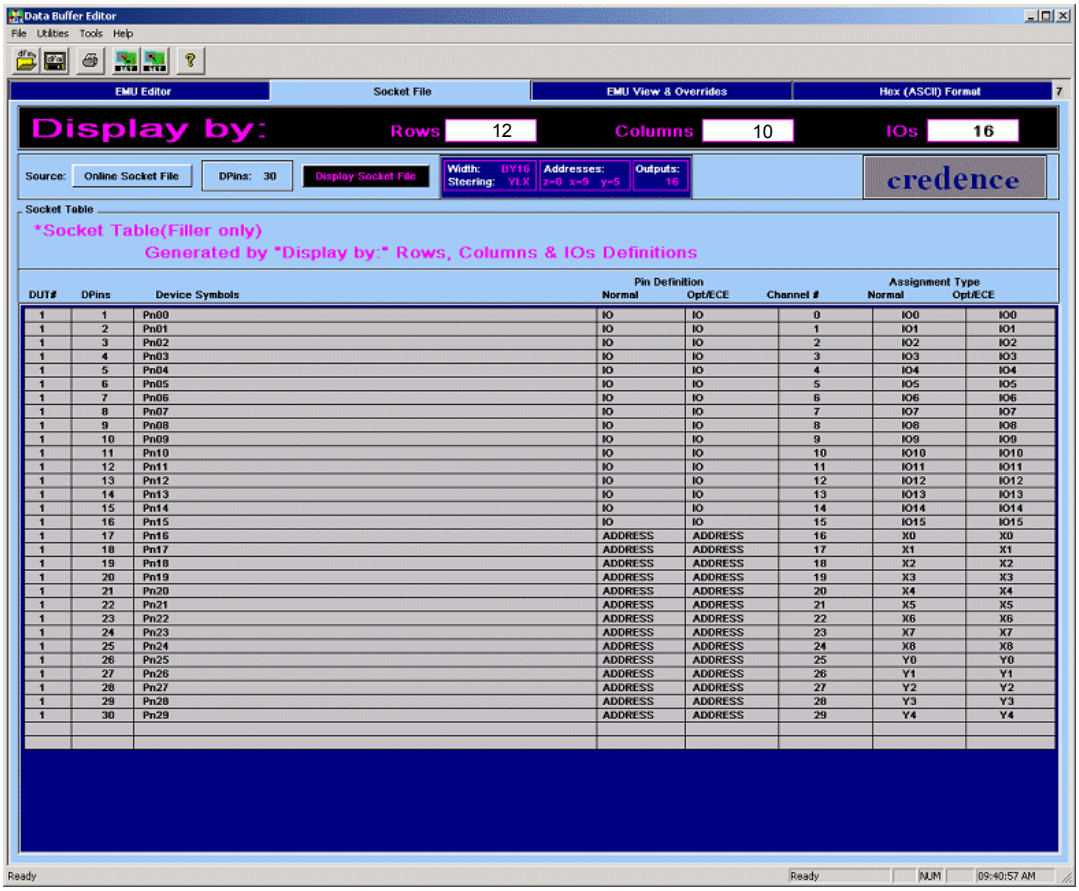
The Socket File provides the compare table for the internal checks when configuring viewing displays, i.e., 16 wide. Only the selected file is used for this purpose and only the Interactive selection allows for generation and/or modification.

NOTE — Online Socket File information can be transferred for display setups.

Defaults

The Socket File (Defaults) property page provides a socket definition to the initialized slice (see Figure 205). Another view is available under Socket File: Online. This view is discussed later in this section.

Figure 205. Socket File - Default


Data Buffer Editor
File Utilities Tools Help
EMU Editor
Socket File
EMU View & Overrides
Hex (ASCII) Format
Display by:
Rows 12
Columns 10
IOs 16
Source: Online Socket File
DPins: 30
Display Socket File
Width: BY16
Steering: YLX
Addresses:
Outputs: 16
credence
Socket Table
*Socket Table(Filler only)
Generated by "Display by:" Rows, Columns & IOs Definitions
DUT# DPins Device Symbols Pin Definition Normal Opt/ECE Channel # Assignment Type Normal Opt/ECE
1 1 Pn00 IO IO 0 IO0 IO0
1 2 Pn01 IO IO 1 IO1 IO1
1 3 Pn02 IO IO 2 IO2 IO2
1 4 Pn03 IO IO 3 IO3 IO3
1 5 Pn04 IO IO 4 IO4 IO4
1 6 Pn05 IO IO 5 IO5 IO5
1 7 Pn06 IO IO 6 IO6 IO6
1 8 Pn07 IO IO 7 IO7 IO7
1 9 Pn08 IO IO 8 IO8 IO8
1 10 Pn09 IO IO 9 IO9 IO9
1 11 Pn10 IO IO 10 IO10 IO10
1 12 Pn11 IO IO 11 IO11 IO11
1 13 Pn12 IO IO 12 IO12 IO12
1 14 Pn13 IO IO 13 IO13 IO13
1 15 Pn14 IO IO 14 IO14 IO14
1 16 Pn15 IO IO 15 IO15 IO15
1 17 Pn16 ADDRESS ADDRESS 16 X0 X0
1 18 Pn17 ADDRESS ADDRESS 17 X1 X1
1 19 Pn18 ADDRESS ADDRESS 18 X2 X2
1 20 Pn19 ADDRESS ADDRESS 19 X3 X3
1 21 Pn20 ADDRESS ADDRESS 20 X4 X4
1 22 Pn21 ADDRESS ADDRESS 21 X5 X5
1 23 Pn22 ADDRESS ADDRESS 22 X6 X6
1 24 Pn23 ADDRESS ADDRESS 23 X7 X7
1 25 Pn24 ADDRESS ADDRESS 24 X8 X8
1 26 Pn25 ADDRESS ADDRESS 25 Y0 Y0
1 27 Pn26 ADDRESS ADDRESS 26 Y1 Y1
1 28 Pn27 ADDRESS ADDRESS 27 Y2 Y2
1 29 Pn28 ADDRESS ADDRESS 28 Y3 Y3
1 30 Pn29 ADDRESS ADDRESS 29 Y4 Y4
Ready
Ready
NUM
09:40:57 AM

The Default Socket File has no relationship to any device types. Its prime use is to ensure that the application initializes with some pre-defined conditions, these are 16 IOs, 4 Meg of addressing and device symbols from pn00 to pn47.

Online

The Online Socket File provides a viewer for looking at the socket definition of the currently loaded program file.

The Online Socket File in is divided into two areas (as with most property pages): control area and displayed area. The displayed area is a read only view of the current socket file.

The first three columns show the device information of Dpins, device symbol and the type of function of the Dpin. The remaining columns show the Kalos 2 system definitions channel number, DPS number, ground, channel type, and address decoder assignment.

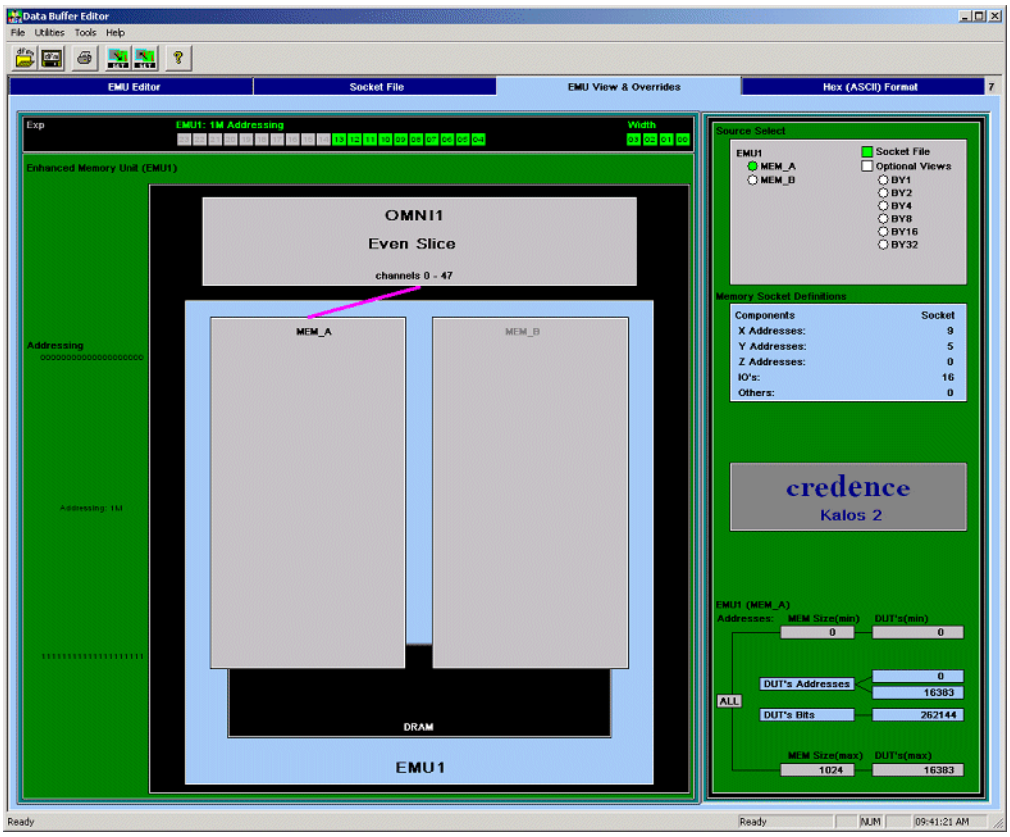
DBM Viewer and Overrides (Buffer Memory)

The pattern segments provide a way for segmenting the current DBM pattern (ALL) into 256 pieces, allowing utility viewers to focus on specific segments of the pattern. There are two areas of focus on this property page. The following describes the two areas (see Figure 206).

Pattern DBM section, left sub-slice, is used to define the “ALL” for this DBM Pattern and up to eight segments. The segments can be anywhere inside the ALL definition and can overlap one another.

The alternating (A/B...A/B) DBM addressing is only a graphical representation of the current Kalos 2 SRAM (256 Megbit). Note that the steering addresses are defined at the top of the slice (26 through 06, 30, 36 through 31). Bit 30 is the bank switching for this configured SRAM.

Figure 206. DBM View and Override (Buffer Memory)



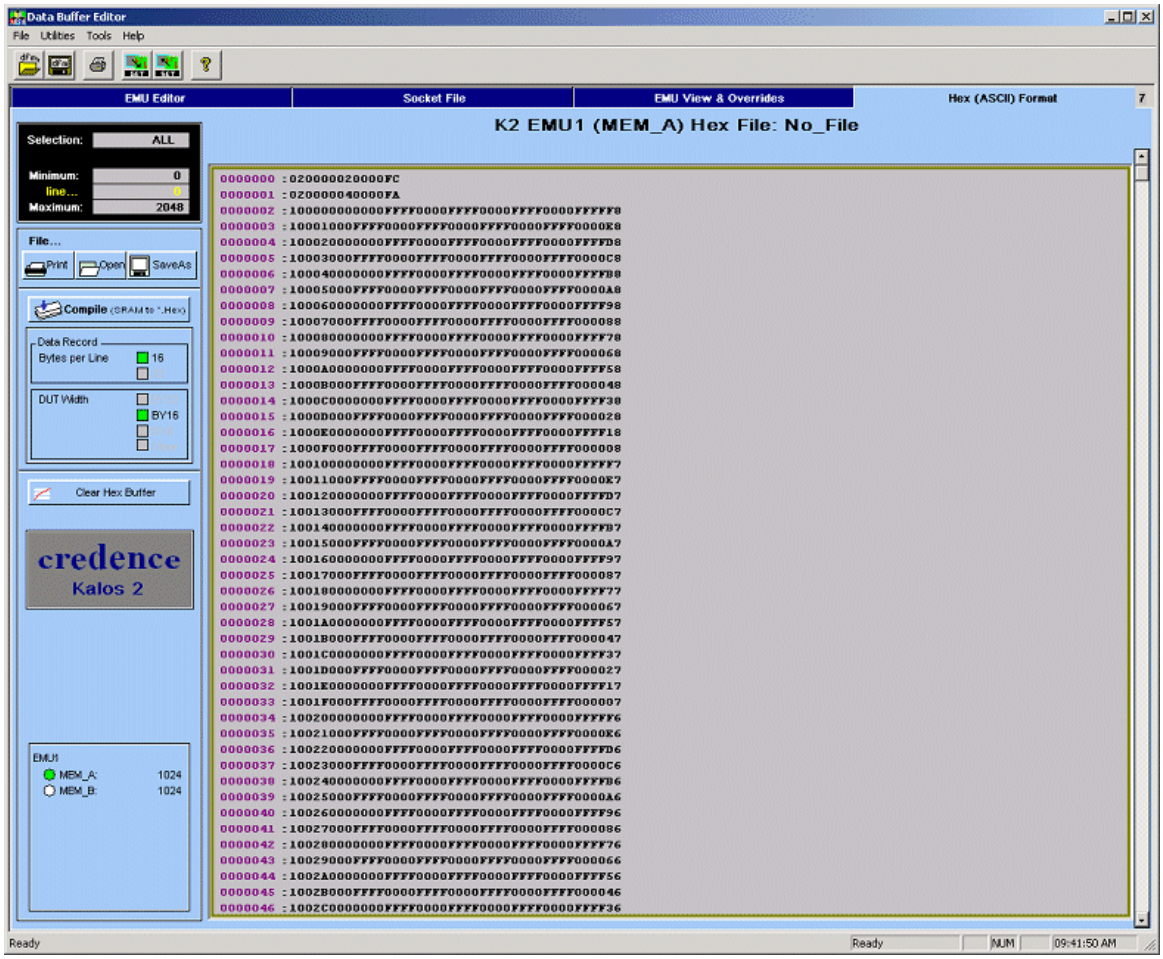
Hex Format

Hex format defines a custom format (Hex) for viewing the DBM data of the selected memory buffer file. The Hex format is an ASCII file. Currently this is the only format that is supported by the Kalos 2 operating system.

```
:020000020000FC                                Extended Segment Address
:020000040010EA                                 Extended Linear Address
:10000000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF00     Addr 0000 - Data
Record
:10001000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF0

:10FFF000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF91     Addr FFF0 - Data
Record

:00000001FF                                     End-of_FileRecord
```

Figure 207 is an example that illustrates 16 byte count record, with addressing for a 16 wide device.

Figure 207. Translation Format (Hex)



NOTE — Kalos currently supports only BY8, BY16, and BY32.

The example shows:

- 16 Bytes per line
  Record Type: first 8 positions
  Data: 9 through 40
  Checksum: 41 and 42
- 32 Bytes per line
  Record Type: 1 through 8
  Data: 9 through 56
  Checksum: 57 and 58

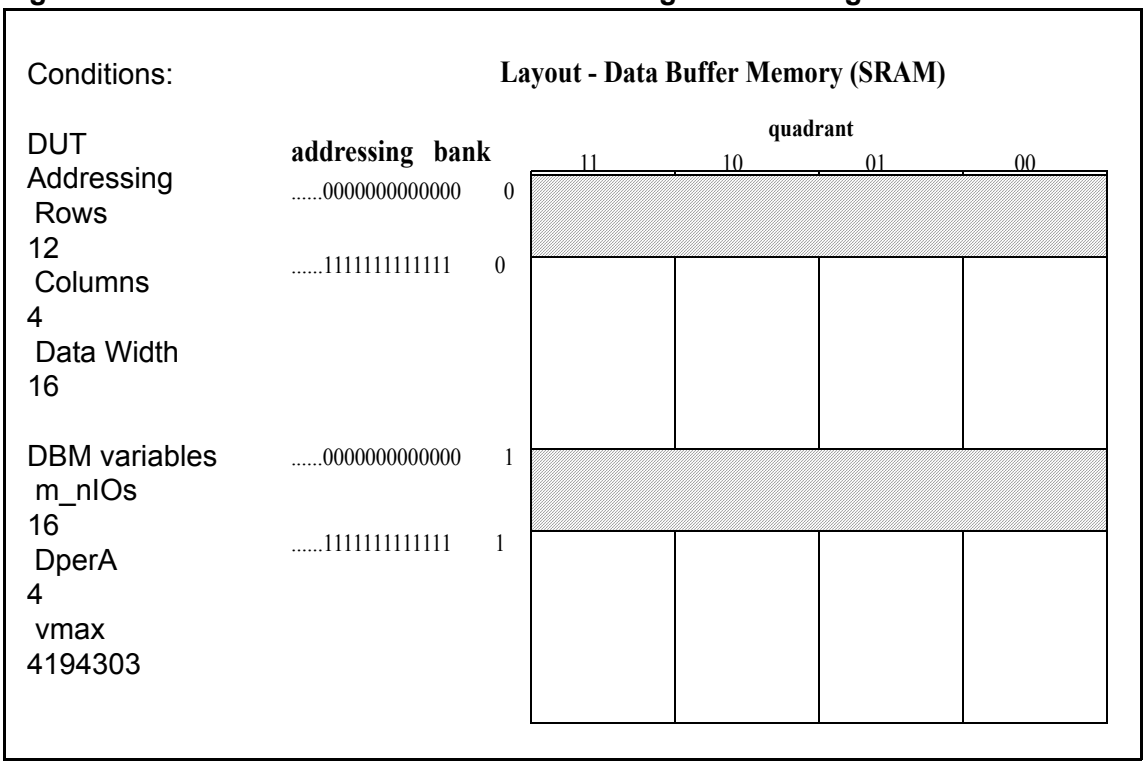
Example

Printout of a DBM (*.hex file)

```
:020000020000FC
:020000040000FA
:10000000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF00
:10001000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF0
:10002000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFE0
:10003000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFD0
:10004000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFC0
:10005000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFB0
:10006000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFA0
:10007000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF90
:10008000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF80
:10009000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF70



:10FFD000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFB1
:10FFE000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFA1
:10FFF000FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF91
:00000001FF
```

Test suite (default Q16 4 M)

Figure 208. DBM Editor - Default 16 Wide 4 Megs Addressing



Multiple DBM Files Per Program

In the releases of Kalos software versions 1.9.5 and higher, the end user is allowed the flexibility to choose between one of multiple hex files to load with the device program. This is accomplished by declaring a generic load within the KTL program, and using a project file (KPJ) to list a configuration that points to a source directory for the DBM files.

The syntax for both KTL and KPL is listed below:

KTL Syntax:

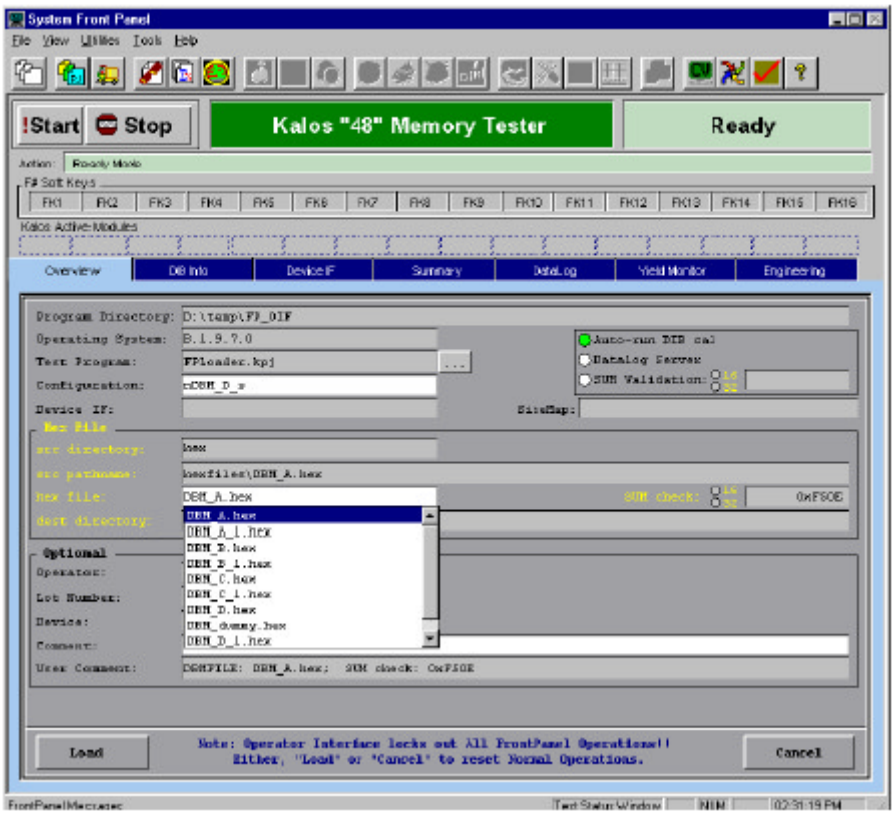
```
LOADDBM hex_dbm = {
FILE = "hextest";           //This generic file is required to be in
PGDBM = DBM1;               //the subdirectory with the object files.
DUTWIDTH = 16;
CHECK = TRUE;
};
```

KPJ Syntax: Minimum requirements

```
[nDBM_D_s]                          [program selection description]
socket = single                     Name of the Socket table to load
subdir = TEST_DBMD                  Subdirectory for the object code
dbm_source = hexfiles               Source directory for the DBM files
```

Launching the Operator IF is done by clicking on the Operator IF Icon in the top left corner of the Front Panel. When the KPJ is loaded into the Operator IF, the DBM area of the Operator IF becomes active (if the keywords are in the KPJ). This allows the operator to load any one of the hex files listed within the dbm_source directory. (see “Operator IF Hex Load” below).

Operator IF Hex Load



Load Time Calculations

Checksums on the Kalos can be calculated in many ways. One way is to calculate a file specific “SUM Check”. This is done by loading a DBM file into Kalos Front Panel using the Operator IF (version 1.9.7 and Higher). The algorithm used to calculate the SUM Check simply sums the individual line checksums (line checks) in the hex file. The result is a unique SUM check for the DBM files. (see “Operator IF Hex Load” above).

Within the Operator IF there is some validation for the SUM Checks to be as expected. In the upper left corner there is the option to select “SUM Validation”. Enabling this function required the person loading the program to enter the expected

value to the SUM check. If this value does not match the calculated value for this DBM

file, the load operation is aborted.

Run Time Calculations

In the releases of Kalos software versions 1.10.1 and higher, the end user has been

allowed the flexibility to choose between one of two functions to calculate checksums or

CRC's on the data loaded into the DBM by using TPE functions. These functions read

back a section of the DBM data determined by the programmer, and calculate either a

simple sum, or a CRC (cyclic redundancy check) of the data within this area. These

functions are listed below.

TPECheckCRCDbmData

Synopsis

UINT TPECheckCRCDbmData(TPE_PG tpe_pg,UINT dutWdth,UINT

phy_addr,UINT len,UINT crc)

Description

This function This function performs a 32 bit cyclical redundancy check

on data in the

DBM.

Arguments

TPE_PG tpe_pg - one of: TPE_PG1 | TPE_PG2

UINT dutWdth - DUT width, width of data bus. Valid choices are 1, 2, 4,

8, 9, 16, and

18.

UINT phy_addr - starting address.

UINT len - number of addresses to include in check.

Return

Thirty-two bit unsigned value which is the CRC of the bytes representing

the DUT

data.

TPEChecksumDbmData

Synopsis

UINT TPEChecksumDbmData(TPE_PG tpe_pg,UINT dutWdth,UINT phy_addr,UINT len)

Description

This function performs checksum on data in the DBM.

Arguments

TPE_PG tpe_pg - one of: TPE_PG1 | TPE_PG2

UINT dutWdth - DUT width, width of data bus. Valid choices are 1, 2, 4, 8, 9, 16, and 18.

UINT phy_addr - starting address.

UINT len - number of addresses to include in check.

Return

Thirty-two bit unsigned sum of the bytes representing the DUT data.

Datalog Engine and DLOG Engine

Data Engine and Dlog Engine are highly customizable datalog utilities for Kalos2 series testers. Both utilities generate several standard and user defined file formats for device testing results.

Both Data Engine and Dlog Engine are referred to as DE in this chapter. If either program is specified directly, that reference applies to a specified program only.

Differences Between Data Engine and Dlog Engine

Data Engine and Dlog Engine are the same application intended to work with different versions of Kalos 2 Software (refer to Kalos 2 External Datalogging Overview).

- Data Engine for Kalos 2 Software version 1.9 and before.
- Dlog Engine for Kalos 2 Software version 1.10 and after.

The difference is the way the applications are connected to Kalos 2 datalog, from which they receive data:

- Data Engine uses Dlogserver for connection.
- Dlog Engine connects directly.

Dlog Engine includes all functions of Data Engine, Dlogserver, STDF.ini file parsing (refer to Use of Runtime Decode Strings and STDF.ini), and other functions that require modifications in Dlogserver.

Although DLLs (Dynamic Link Library) for both applications have the exact same functions, they are NOT interchangeable.

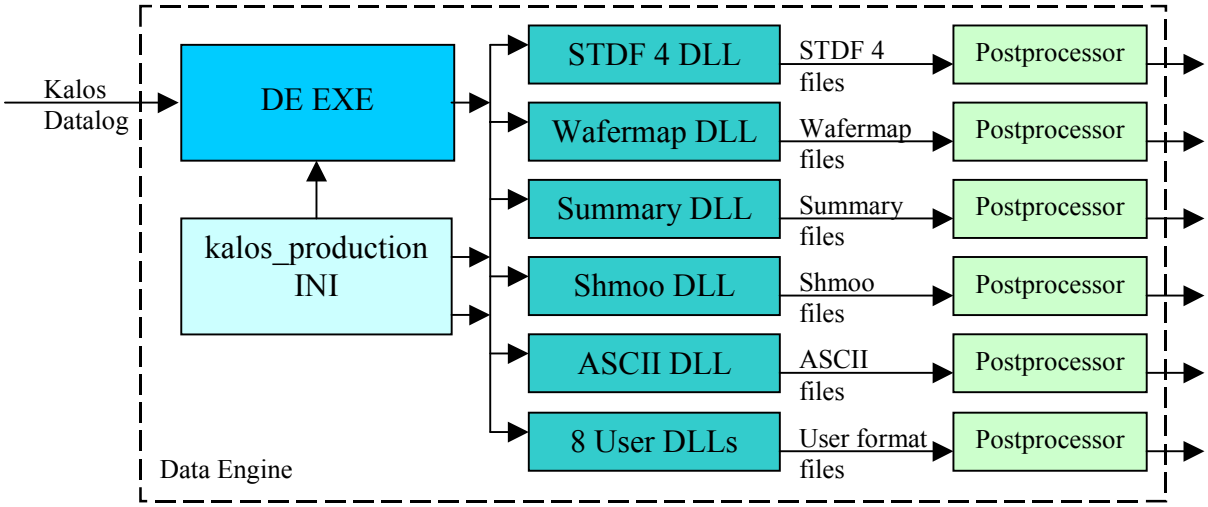
DE Structure

DE receives all necessary data from the Kalos 2 datalog stream (refer to Kalos 2 External Datalogging Overview). Data is received by messages. Each message is a structure containing several variables. For example, start wafer message contains lot name, wafer number, and wafer ID.

All configuration settings of DE are stored in the *kalos_production.ini* file (INI file), which is located in the *%KALOS_HOME%\Test\DeviceIF* directory. *%KALOS_HOME%* is the Kalos 2 software install directory, which is *C:\Kalos* by default (refer to Configuration with kalos_production.ini, also see Figure 209).

DE mainly consists of one main EXE file and several DLLs. The main EXE file is responsible for receiving data from Kalos 2 datalog stream (refer to Kalos 2 External Datalogging Overview), processing it, and exporting it to DLLs. Each DLL is responsible for specific file format creation. There are several standard DLLs delivered with DE. Users can also add DLLs for custom file format generation.

Figure 209. DE Structure



Standard DLL formats are:

- STDF 4 (Standard Test Data Format) file.
- Wafermap (multiwafermap) file.
- Summary file for wafer and lot.
- Shmoo file for wafer.
- ASCII text file (The ASCII.dll is no longer supported, however, it remains for legacy applications only.)

DLLs must adhere to a specific structure of exported functions to be correctly loaded and initialized by DE EXE. Call functions exported by main EXE can be included. Refer to Custom DLL Creation for additional information on DLL structure and adding user custom DLLs.

Although DLLs for both Data Engine and Dlog Engine have the exact same functionality, they are NOT interchangeable.

All created datalog files are processed by a postprocessor. By default the postprocessor is one batch file for all DLLs (def_move.bat), which copies generated files to a destination folder (this can be a network folder). It is possible to have different batch or executable files as postprocessors for each DLL (refer to Postprocessor).

DE GUI

A DE icon (refer to DE menu with Data Engine Icon) is displayed in the system tray near Windows™ clock. Right mouse click to invoke the menu:

- Settings – displays DE settings dialog.
- About – displays DE about box.
- Exit – closes DE.

Figure 210. DE menu with Data Engine Icon

Settings Dialog

The Settings dialog permits switching on/off generation of certain file types. This dialog is locked out in production mode. Kalos_production.ini file contains all of these settings (refer to Configuration with kalos_production.ini), but changes in the GUI do not affect the INI file. All changes in the GUI are lost after DE restart. Kalos_production.ini file must be edited for permanent changes.

If the DE cannot load a DLL in the path specified in the INI file, the corresponding checkbox is disabled.

DE standard DLLs are switched on/off by checkboxes:

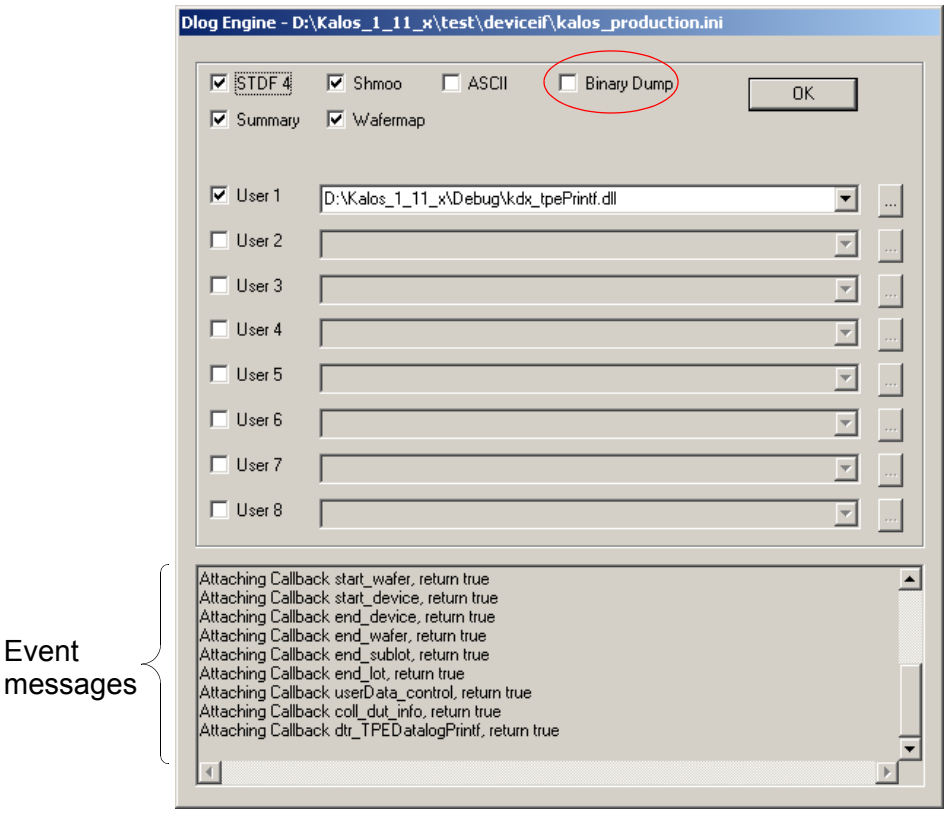
- STDF 4
- Wafermap
- Summary
- Shmoo
- ASCII (The ASCII.dll is no longer supported, however, it remains for legacy applications only.)

DE datalog binary file collection is switched on/off by **Binary Dump** checkbox (see Figure 211). DE custom DLLs are switched on/off by **User 1**, **User 2, etc.,** checkboxes. Paths to these DLLs can be set in corresponding edit boxes.

Events such as DLLs loading/unloading, the creation of a test results file and warning messages are displayed in the field at the bottom of the dialog window. All messages can also be written to the DE text dump file (refer to Collecting Log Files for Debugging).

The current kalos_production.ini path is displayed in the header of the settings dialog.

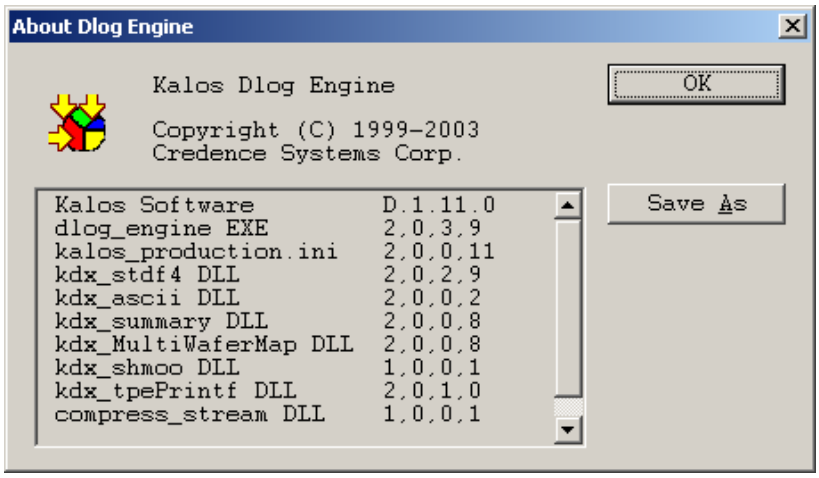
Figure 211. Settings dialog



About Box

The About box displays versions of Kalos Software, DE EXE, all loaded DLLs (including user DLLs), and kalos_production.ini. Version information can be saved to a text file with the **Save As** button and standard save dialog.

Figure 212. About dialog



Postprocessor

All standard datalog files are processed by a postprocessor. User DLLs must include an applicable API call to invoke the desired function(s) (refer to Create Custom Code). Postprocessor can be a batch file or executable file.

By default, there is one batch file (def_move.bat) for all DLLs, which copies generated files and sends them to this destination folder, which can be a network folder. All processed files and errors of file processing are logged by default and sent to the **%KALOS_HOME%\test\data_engine\def_move.log** file.

The destination folder and the path name of the postprocessor file are set in kalos_production.ini by DESTINATION_DIR and POSTPROCESSOR fields accordingly. It is possible to use different postprocessors or copy files to different folders for each DLL. However, it is necessary to use local overrides of these fields in the INI file for these purposes.

DE passes several parameters with command line to the postprocessor. Following is the list of command line corresponding flags:

- file_type (-t) – type of file (kdx_stdf4, kdx_summary, kdx_user etc.)
- inFile (-f) – name of processing file
- sourceDir (-s) – source directory of file
- destDir (-d) – destination directory of file
- logFile (-l) – name of log file for messages

For example, command line *-t kdx_stdf4 -s D:\logfiles -d D:\logfiles\dest -f example.std* creates the script to move STDF 4 type file **example.std** from **D:\logfiles** to **D:\logfiles\dest**.

The default def_move.bat script consists of three main sections: command line parameter parsing, processing, messages, and errors handling.

- In the first section, script parses the command line to get passed parameters. Usually this section does not require modifications.
- In the second section of the default script the most significant is the move command from the source directory to the destination. The defaults are the command line parameters:

  move %sourceDir%\%inFile% %destDir%\%inFile%

  Users are free to modify this command.
- If the source file or destination directory does not exist, the script performs a corresponding error handling at the end of the batch file. Error handlers write the error message to the log file and exit from the script. Users are free to add error handlers here or modify the behavior of the existing ones.

Refer to DOS batch file documentation for the script command syntax. Type *help* from a DOC command shell for a list of commands.

Collecting Log Files for Debugging

DE has the capability to create log files. These files can be used for debugging purposes. The primary one is datalog binary file. Other files are supplemental.

Datalog Binary Dump File

DE receives data from the datalog and saves it to a datalog binary dump file without any changes. This allows users to recreate the DE state later. It is advisable to enable this option if problems with DE are encountered. It is commonly used for customer support purposes.

This function is enabled and adjusted using BINARY_ENABLED, COMPRESS_TYPE, BINARY_SPLIT_LOTS, ADD_BIN_HEADERS, BINARY_DIR, DISK_SPACE_LIMIT, and BINARY_ROTARY fields in kalos_production.ini (refer to DE Global Settings).

The datalog file can be collected with real-time compression (COMPRESS_TYPE is 1). This saves hard disk space significantly. The option must not be used in the crash condition, as a ZIP file is not readable.

The ZIP file must be closed by switching the **Binary Dump** checkbox to off on the Settings dialog.

If the file was created using real-time compression, decompressing the created file and compressing it back with third party ZIP or RAR compressors is recommended. This provides higher compression rates. The purpose of the DE compressor is to provide *real-time* compression, not the *highest* compression rate.

Text Dump File

Events such as DLLs loading/unloading, test results file creation, and warning messages are displayed in the field at the bottom section of the settings dialog. All messages can also be written to the DE text log file.

The file collection can be enabled and adjusted using KDX_LOG_DUMP and DUMP_DIR fields in kalos_production.ini (refer to DE Global Settings).

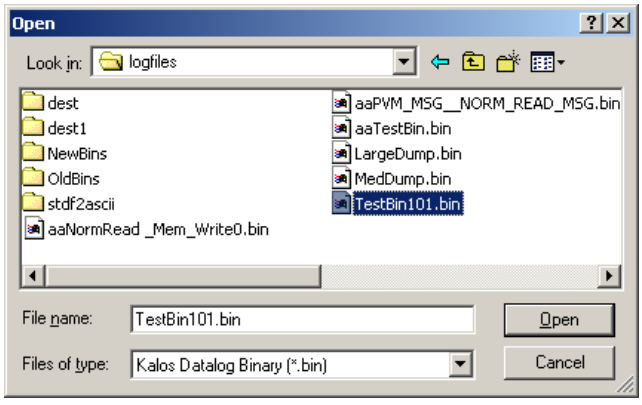
Postprocessor Dump File

The default postprocessor (def_move.bat) uses another log file (refer to Postprocessor). Errors are logged by default for all processed files to the **%KALOS_HOME%\test\data_engine\def_move.log** file. The file name and logging process can be adjusted by modifying the postprocessor script.

Offline Mode

DE in offline mode does not connect to Kalos 2 datalog, and it uses the datalog binary file as input. Offline mode recreates the runtime environment using the data in the binary file. Selection of Online/Offline modes is performed by the *OFFLINE* key in the [DATA ENGINE] section of the kalos_production.ini. If this key is true, the binary file, *open,* dialog appears at DE startup. The datalog binary file, TestBin101.bin, is supplied for customer support purposes.

Figure 213. Binary File Selection in Offline Mode



Production/Engineering Modes

Production and engineering modes are very similar. Depending on the current mode, MIR.MODE_COD field in STDF gets P and E (Production/Engineering) values, respectively. In production mode the settings dialog is locked out.

Selection of Production/Engineering modes is performed by the NT_PROD_NAME key in the [DATA ENGINE] section of the kalos_production.ini. When the user login name specified matches the current user, production mode is selected; otherwise, engineering mode is selected.

Disabling File Generation for Specified Flow

It is possible to disable/enable file generation for a specified flow by changing the KPJ file. All flows are enabled by default.

Change *de_output_general* to set the general setting for all flows for that configuration (value can be *disabled* or *enabled*).

Making this change by name of flow overrides the general setting (value can be de_output_disabled or de_output_enabled).

In the following example *Check_Chip1_flow* flow generates files that other flows will not generate.

```
[General_1]
socket = single_1
config = single1_conf
subdir = general_1
de_output_general = disabled
Check_Chip1_flow = de_output_enabled
```

Test Program Loading After Dlog Engine Startup

If the test program is not loaded after Dlog Engine startup, files will not be generated. Dlog Engine receives socket table, bin table, and flow information at test program loading. Files generated without that data contain improper data.

In offline mode files are always generated.

Icon Displaying Enabled/Disabled State

The Dlog Engine icon changes displaying enabled/disabled state (as shown in Figure 214); disabled state indicates files will not be generated. State is always enabled in offline mode, and may be disabled in online mode in the following cases:

- Runtime connection failed (e.g., TTarget was not started).

- Selected flow is disabled.
- Test program is not loaded after Dlog Engine startup.

Figure 214. Dlog Engine Icon Enabled/Disabled States

Enabled state Disabled state

STDF Viewer Utility

A STDF file viewer (stdf2ascii.exe) is supplied with the DE utility. This command line utility translates STDF to a text file. The following command line translates input.std to output.txt:

stdf2ascii -f input.std > output.txt

The generated file format appears as follows:

```
…
REC_LEN (2)      REC_TYP (5) REC_SUB (10)
Pir.head_num     =   1
Pir.site_num     =   0

REC_LEN (46)     REC_TYP (15)  REC_SUB (10)
Ptr.test_num      =  10
Ptr.head_num      =  1
Ptr.site_num      =  0
Ptr.test_flg         0x0
Ptr.parm_flg      =  0x0
Ptr.result        =  0.2
Ptr.test_txt      =  judgeRes
Ptr.alarm_id      =
Ptr.opt_flag      =  0xE
Ptr.res_scal      =  3
Ptr.llm_scal      =  0
Ptr.hlm_scal      =  0
Ptr.lo_limit      =  0
Ptr.hi_limit      =  3
…
```

Installation Procedure

The Dlog Engine is installed with Kalos 2 Software. The Data Engine requires a separate installation.

DE (Data Engine) installation for the production environment is performed as a standard Windows installation. Manual intervention (actions) are required only to transfer changes from the previous installation and for the engineering environment.

Data Engine General Installation Procedure

This section describes the Data Engine installation procedure using the installation script.

The Data Engine requires that Kalos 2 Software is installed on the system. Following are steps to install the Data Engine in the production environment.

- Exit all Windows applications.
- Run Data Engine installation file SetupDataEngine.exe.
- Wait while setup is preparing for installation.
- Press the *Next* button on the displayed **Welcome** dialog.
- Specify Kalos 2 home directory for Kalos 2 software on the **Choose Destination Location** dialog. Usually, it is *C:\Kalos,* which is the default. Press the *Next* button after setting directory.
- Wait while the installation copies files.
- Press the *OK* button on the installation completion message box.
- Restore Data Engine previous configuration if it existed earlier (refer to Configuration Transferring from Previous Installation).

These steps conclude Data Engine setup. Setup process can be interrupted at any step by pressing *Cancel* and then *Exit Setup* buttons.

Configuration Transferring from Previous Installation

If a previous version of DE installation exists, the old configuration files (kalos_production.ini, def_move.bat, Kalos_startup.bat) are not replaced by the new DE installation. The newer versions of files are installed in the same directories with other names representing versions (for example, Data Engine 2.0.3.4 becomes kalos_production2034.ini, def_move2034.bat, Kalos_startup2034.bat).

After installation, users can transfer the previous configuration to the new installation in several ways.

NOTE — Newer versions of DE may have configuration files with additional fields.

- If the installed version of DE is the same as the previous version, no actions are necessary.

- If the version is changed and there are minor and known changes in the configuration files, it is possible to recreate the changes manually in the new files using previous files as references. Replace previous files with new ones.
- If the version is changed, leaving the previous kalos_production.ini file is recommended. If the newly installed DE is an older version, new fields are ignored. If the newly installed DE is a newer version, default values are used instead of missing fields, although this is not related to the custom DLL fields.

If custom DLLs were used in the previous installation, they will not be removed by DE install. Their configuration in the kalos_production.ini must be transferred as described above. If these DLLs were removed due to complete system reinstall or other causes, they must be installed in their usual way.

Changes Needed for Engineering Environment

In the production environment, *Kalos_startup.bat*, batch file is used for DE startup. DE install script automatically adds a shortcut to this file in the Windows startup folder. In engineering environment, Kalos_startup_for_kconfig.bat, batch file and Kalos Configuration Manager must be used for startup in the engineering environment. This batch file is put in *C:\WinNT* by the installation. The following steps are required for this purpose.

- In the C:\WinNT\Profiles\All Users\Start Menu\Programs\Startup directory, remove the *Kalos Startup* shortcut.
- In this directory, add a shortcut to *War* from %KALOS_HOME%\bin.
- In the Kalos 2 Configuration Manager select the **Option|Customize...** menu and then select **Add Application...**
- Use the browse window to go to C:\WinNT.
- In the File name: selection box type in *.bat and press **Enter**. A file called *Kalos_startup_for_kconfig.bat* appears.
- Select this file and press OK. The new icon (looks like a computer) for the batch file appears on the Kalos 2 Configuration Manager.

TTarget (refer to Target Manager in the Introduction to KITE (Kalos 2 Integrated Test Environment) chapter of this manual for details) must be started before Dlogserver and Data Engine. Dlogserver will not attach to core software if started before TTarget.

If TTarget is restarting, Dlogserver and Data Engine must be closed using the tray icon (near Windows clock) before starting TTarget.

TTarget and Dlog Engine startup sequence does not matter.

Configuration with kalos_production.ini

The kalos_production.ini file (INI file) contains settings for the DE, prober drivers, and custom GUIs. DE settings make up the majority of the kalos_production.ini file. They consist of DE global settings, DE standard DLL settings, and DE custom DLL settings. The five main standard DLLs for the DE are STDF4, wafermap (multiwafermap), summary, shmoo, and ASCII datalog.

The default path for kalos_production.ini is *%KALOS_HOME%\Test\DeviceIF\kalos_production.ini*. It is possible to specify another INI file at DE startup as the parameter in the command line. It is especially used for working in offline mode.

The current kalos_production.ini path is displayed in the header of the settings dialog.

DE Global Settings

Global settings to the DE are those used if no local settings are specified. The global [DATA ENGINE] section contains many settings that can be repeated in the local settings of DE DLLs. For that reason, settings for the individual DLLs are called local overrides. For example, if FILENAME is specified under the section labeled [kdx_summary], the local override FILENAME is used for summary files, instead of that specified under [DATA ENGINE] section. If duplicate settings exist, the setting under the local override is used.

Global settings are:

[DATA ENGINE]
Beginning of section of DE global settings.

REVISION = 2,0,0,7
Revision number of the kalos_production.ini file. Not to be confused with the DE major revision.

NT_PROFILING = True ; Can be [True | False | 1 | 0]
When this setting is True, the operator name in any output file is the user name for NT.

NT_PROD_NAME = prod
Login, which is used for setting production mode (refer to Production/Engineering Modes).

OFFLINE = 1 ; Can be [True | False | 1 | 0]
Option to set offline mode (refer to Offline Mode).

KDX_DLL_DIR = $(KALOS_HOME)\test\data_engine
The directory of the DE DLLs location. User defined DLLs can also be in this directory.

OUTPUT_DIR = D:\logfiles
The directory location for data files created by the DE DLLs. Users can go to this directory to view data created during test. For each data DLL, a unique OUTPUT_DIR can be specified in the local override. For example, if all summary files are to go to the D:\summary directory, specify OUTPUT_DIR = D:\summary under the [kdx_summary] local override section. [kdx_summary] default is usually logfiles\summary.

DESTINATION_DIR = D:\logfiles\dest
Destination directory for data files. Used with the postprocessor.

POSTPROCESSOR = %KDX_DLL_DIR%\def_move.bat
Location and filename for a postprocessor file that executes at the end of each file generation. The default file is def_move.bat, which moves files created during data collection from OUTPUT_DIR to DESTINATION_DIR.

FILENAME =
%machine_id%_%lotname%_%start_time="%b_%d_%Y_%H%M%S"%
Global default for file naming convention used in non-probe situations. The basic difference between FILENAME and WAFER_FILENAME is the default WAFER_FILENAME always includes the wafer number. WAFER_FILENAME, explained below, is used in probe situations.

WAFER_FILENAME =
%machine_id%_%lotname%_%wafer_num=INT00%_%start_time="%b_%d_%Y_%H%M%S"%
Global default for file naming convention used in probe situations with wafers. Options for the filename are by default:
%machine_id% - machine ID.
%lotname% - as specified in the Front Panel Overview **Lot:** entry.
%wafer_num = INT00% - wafer number, integer format, two characters, e.g., *01*,
%start_time = %b_%d_%Y_%H%M%S - time that file is created. The month, day, and year are %b, %d, and %y, respectively. Hour, minutes, and seconds are %H, %M, and %S, respectively.

LOWERCASE_FILENAME = false ; Can be [True | False | 1 | 0]
Option to make the filename lowercase.

BINARY_ENABLED = FALSE ; Can be [True | False | 1 | 0]
If set to 1 (TRUE), a datalog binary dump file is created (refer to Collecting Log Files for Debugging). This setting can also be changed in the DE Settings box in the **Binary Dump** check box.

COMPRESS_TYPE = 1 ; Can be [0 - no compression | 1 - ZIP]
Option to compress datalog binary file in real-time during its creation. If set to 0, an ordinary binary file is created. If set to 1, binary file is created and compressed to ZIP format. Due to large sizes of binary files (hundreds of megabytes per lot) and high (~90%) compression ratio, this feature helps to save hard disk space or collect much more data.

BINARY_SPLIT_LOTS= FALSE ; Can be [True | False | 1 | 0]
Option to split datalog binary file per lots. If set to 1, the current binary file is closed and a new one is opened after the end of each lot. This avoids extra large binary files creation.

ADD_BIN_HEADERS = True ; Can be [True | False | 1 | 0]
Option to add header data at the start of every lot file if split lot feature is enabled. These headers include data, which is received only once at test program, or prober/handler DLLs loading and runtime decode strings.

BINARY_DIR = d:\binFiles
Directory of the binary files location, when BINARY_ENABLED = TRUE.

DISK_SPACE_LIMIT = 300; in Mb, <=0 – don't check
Hard disk free space limit in Mb for datalog binary file logging. Logging of the datalog file stops when reaching this limit. Creation of test result files (STDF, wafermap etc.) continues. Setting this limit above 50 percent of the total hard disk free space is not recommended.

BINARY_ROTARY= False ; Can be [True | False | 1 | 0]
When true, remove oldest datalog binary file in user directory when hard disk space limit is reached.

KDX_LOG_DUMP = FALSE ; Can be [True | False | 1 | 0]
In the DE and data DLLs, there may be many kdx_printf() statements, which work like printf() C statements for the text output. This information appears in the DE settings dialog if this parameter is true. This can be used for the debugging of custom user DLLs (refer to Collecting Log Files for Debugging).

DUMP_DIR = %OUTPUT_DIR%
Directory location for kdx_printf() debug information, when KDX_LOG_DUMP = TRUE.

DIB_NVM_INFO = False ; Can be [True | False | 1 | 0]
Option to include *DIB part* and *DIB serial* fields into the wafermap, summary and shmoo files. The data are read from NVM on the Kalos board, and also displayed in the Overview section of Front Panel.

PROCESS_RETEST = False ; Can be [True | False | 1 | 0]
Option to take into account die retest; to never have die counters over the real gross number of dies. This has an effect on all die counters including:

- Counter values returned by Data Engine API.
- Counter values summary files.
- Counter values in PCR, TSR, HBR, SBR records in STDF files.

STDF4_DLL = $\kdx_stdf4.dll
Location and filename of the standard STDF DLL. The default directory is %KDX_DLL_DIR%, also specified in the kalos_production.ini file. The *$* represents the default for this field, which in this case is %KDX_DLL_DIR%.

ASCII_DLL = %KDX_DLL_DIR%\kdx_ascii.dll
Location and filename of the ASCII Datalog dll.

; WAFERMAP_DLL = $\kdx_waferMap.dll
WAFERMAP_DLL = $\kdx_Multiwafermap.dll
Location and filename of the wafermap dll. Currently, there are two options for wafermap: standard wafermap and multi-wafermap. For a more detailed explanation, refer to local override settings below.

SUMMARY_DLL = %KDX_DLL_DIR%\kdx_summary.dll
Location and filename of summary dll.

SHMOO_DLL = $\kdx_shmoo.dll
Location and filename of shmoo dll.

USER1_DLL = $\kdx_tpePrintf.dll
Location and filename of user defined DLL. Eight user defined DLLs may run simultaneously. They should be specified in keys, USER1_DLL to USER8_DLL, respectively.

Local Override Settings for DE DLLs

Local override settings are those intended for each data collection DLL. Local override settings are used instead of global settings, if they are specified in the section of that DLL. It is critical that the section name for local overrides is the same as the name of its DLL. For example, the section name for local overrides is [kdx_stdf4]. This must match exactly the name of the STDF4_DLL in the global settings, which is **kdx_stdf4.dll**. The *.dll* extension is not included in the section name.

Many of the local override keys are duplicated, therefore, only a full explanation of the STDF and multi-wafermap are included below. The information in these sections also apply to the Summary, Shmoo, ASCII Datalog, and Wafermap DLLs. For example, *ENABLED = True* may appear in all of the local overrides, but it is only explained in the STDF local override section.

STDF Local Overrides

[kdx_stdf4]
Local overrides header for STDF DLL. Must match the name specified for the DLL in global settings, only without the .dll extension.

ENABLED = True ; Can be [True | False | 1 | 0]
Default switch for active or inactive. If 1 (TRUE), the kdx_stdf4.dll is turned on, by default. This setting can also be changed in the DE Settings box, in the **STDF 4** check box.

FILENAME = %machine_id%_%program_name%_%flow_id%_%lotname%_%start_time="%b_%d_%Y_%H%M%S"%
Local override for FILENAME. Refer to the FILENAME explanation in DE Global Settings.

WAFER_FILENAME = %machine_id%_%program_name%_%flow_id%_%wafer_id%_%wafer_num=int00%_%time%
Local override for WAFER_FILENAME. Refer to explanation of WAFER_FILENAME in DE Global Settings.

FILE_EXTENSION = std
Filename extension, which is used for the output data file.

LOWERCASE_FILENAME = True
Local override for LOWERCASE_FILENAME. Refer to the explanation of LOWERCASE_FILENAME in DE Global Settings.

SITE_255_SUMMARIES = True ; Can be [True | False | 1 | 0]
Some STDF readers automatically generate a site 255. When this is the case, setting this variable to 0 or False turns off the generation of site 255.

LOG_PASS = TRUE ; Can be [True | False | 1 | 0]
STDF option to log results for passed tests. If this setting is 0 (FALSE), results for passed tests are not logged.

LOG_FAIL = True ; Can be [True | False | 1 | 0]
STDF option to log results for failed tests. If this setting is 0 (FALSE), results for failed tests are not be logged.

LOG_PARA = True ; Can be [True | False | 1 | 0]
STDF option to log parametric results. If this setting is 0 (FALSE), parametric results are not logged.

LOG_FUNC = True ; Can be [True | False | 1 | 0]
STDF option to log functional results. If this setting is 0 (FALSE), functional results are not logged.

LOG_DTR = True ; Can be [True | False | 1 | 0]
STDF option to log DTR (Datalog Text Records) records (Refer to Storing ASCII Strings in STDF File). If this setting is 0 (FALSE), functional results are not logged.

SAMPLE_RATE = 5
STDF option to collect data on a sampling basis. For example, if the SAMPLE_RATE is set to 5, data for every fifth device is collected.

SAMPLE_LIMIT = 100
STDF option to limit the data collection to n devices. For example, if SAMPLE_LIMIT is set to 100, data is collected for a maximum of 100 devices on each wafer, then data collection stops. Per lot in final test.

<modifiable field> = <default value>
; atr.cmd_line = %program_name%
...
...
...
; wir.wafer_id = %info_wafer_id%
Fields for STDF values runtime insertion. For example, to change the default behavior runtime setting of value for atr.cmd_line, it is necessary to uncomment corresponding field (i.e., remove ';') in INI file.
An atr.cmd_line in STDF file is a value of any runtime decode string, received by DE with key *program_name* (refer to Use of Runtime Decode Strings and STDF.ini). It is possible to specify another combination of runtime strings for that STDF field, e.g.,
atr.cmd_line = %program_name%_%job_revision%
A atr.cmd_line in STDF file is a combination of values of runtime decode strings with keys *program_name* and *job_revision*.

Multiwafermap Local Settings

The multiwafermap creates a wafermap for both functional and parametric tests. If there are multiple PMU measurements in one test, it uses the results of the last one. The results of the function, TPEJudgeResults(), are also available to the multi-wafermap.

Wafermap creates:

- Hex wafermap.
- Normal wafermap.
- Soft bin wafermap.
- Site wafermap.

Multiwafermap also creates:

- Wafermaps for specific test results.

Selection between wafermap end multiwafermap is performed by the WAFERMAP_DLL key in [DATA ENGINE] section.

[kdx_Multiwafermap]
Beginning of section of local overrides for the multiwafermap DLL. This must match the name specified for the DLL in global settings, without the *.dll* extension.

ENABLED = True ; Can be [True | False | 1 | 0]
Refer to DE Global Settings.

WAFER_FILENAME = %machine_id%_%lotname%_%flow_id%_%wafer_num=INT02%_%time%
Refer to DE Global Settings.

FILE_EXTENSION = wmp
Refer to DE Global Settings.

; LOWERCASE_FILENAME = True
Refer to DE Global Settings.

HEX_MAP = True ; Can be [True | False | 1 | 0]
Option to create wafermap that shows hard bins in hex.

HEX_MAP_WIDTH = 1
Character width of each bin is represented in the wafermap. This indicates how wide each bin location is, and affects the appearance and the readability of the wafermap. This is multiwafermap specific.

NORMAL_MAP = True ; Can be [True | False | 1 | 0]
Option to create wafermap that shows hard bins in decimal.

NORMAL_MAP_WIDTH = 4
Character width of each bin is represented in the wafermap. This indicates how wide each bin location is, and affects the appearance and readability of the wafermap. This is multiwafermap specific.

SOFT_BIN_MAP = True ; Can be [True | False | 1 | 0]
Option to create wafermap that shows soft bins in decimal.

SOFT_BIN_MAP_WIDTH = 4
Character width of each bin is represented in the wafermap. This indicates how wide each bin location is, and it affects the appearance and readability of the wafermap. This is multiwafermap specific.

SITE_MAP = True ; Can be [True | False | 1 | 0]
Option to create a site map wafermap.

SITE_MAP_WIDTH = 6
Character width of each bin is represented in the wafermap. This indicates how wide each bin location is, and it affects the appearance and readability of the wafermap. This is multiwafermap specific.

USER_MAP_1 = 5000
Matching the test number. In this case, test number 5000 is represented in the multiwafermap. This is multiwafermap specific.

USER_MAP_1_WIDTH = 7
Character width of each bin is represented in the wafermap. This indicates how wide each map node location is, and it affects the appearance and readability of the wafermap. This is multiwafermap specific.

USER_MAP_1_NAME = Test 5000 Multi Wafermap 1, values multiplied by 1e9
Title of the wafermap. This is multiwafermap specific.

USER_MAP_1_FMT = %.2f ; The * is required for the width to work*
Standard formatting, based on printf() parameters. **The * is required**. This is multiwafermap specific.

USER_MAP_1_MULT = 9 ;value in nano seconds.
Result is multiplied by 10^x, where x is the value of USER_MAP_1_MULT. For example, if 9 were entered here, the value would indicate nanoseconds. This is multiwafermap specific. *USER_MAP_1_NAME* should reflect this value. Refer to the example above.

NOTE — The above settings can be repeated for additional multiwafermaps, as shown in the example below. This example is currently set to 10 maps (each map has a parametric or functional component).

USER_MAP_2 = 300
USER_MAP_2_WIDTH = 6
USER_MAP_2_NAME = Test number 300.
USER_MAP_2_FMT = %.1f ; The * is required for the width to work*
USER_MAP_2_MULT = 0

Summary Local Settings

LOT_FILE_EXTENSION = lsum
Lot summary file extension.

PROG_FULL_PATH = True ; Can be [True | False | 1 | 0]
Option to put the full path of the test program in the summary files.

LSUM_SITE_INFO = True ; Can be [True | False | 1 | 0]
Option to put the test program site information in the lot summary files.

SITE_LETTER_S = False ; Can be [True | False | 1 | 0]
Option to indicate site by letter *S* instead of *K*.

PHYS_SITES = False ; Can be [True | False | 1 | 0]
Option to indicate a separate summary for each module and phys site.

Shmoo Local Settings

FILE_PER_MODULE = False ; Can be [True | False | 1 | 0]
Option to create separate shmoo file for each module.

CVIEW_FORMATTING = true ; Can be [True | False | 1 | 0]
Option to use formatting for shmoo headers, like in CVIEW.

HIDE_FILE_HEADER = true ; Can be [True | False | 1 | 0]
Option to hide standard file header of files generated by DE.

HIDE_TEST_INFO = true ; Can be [True | False | 1 | 0]
Option to hide sender test information for stings sent by TPEDatalogPrintf(), if FILE_PER_MODULE option is enabled.

Kalos 2 External Datalogging Overview

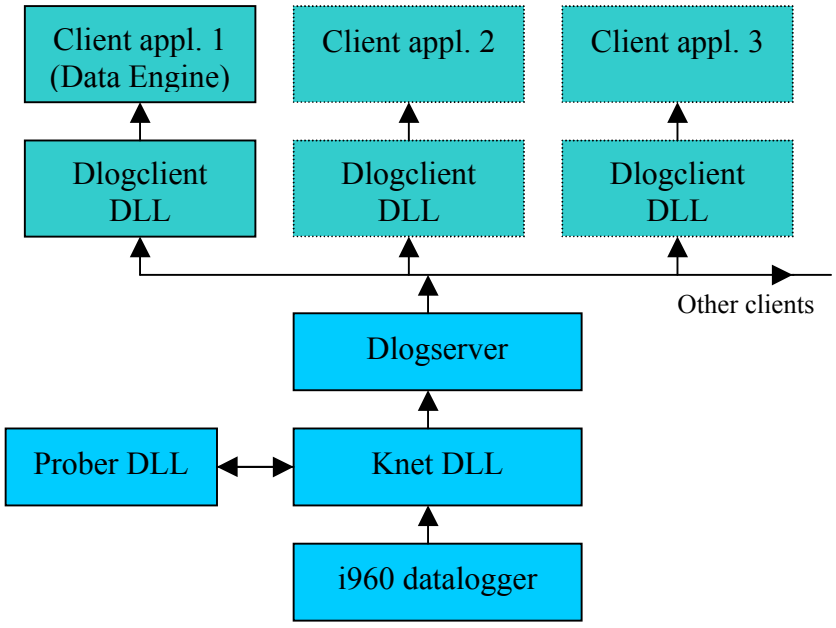
DE saves testing results in several formats, including user defined formats. DE receives all necessary information from Kalos 2 datalog. Datalog can be enabled by the TPEDatalogOn() function or by the buttons on the DataLog tab of Front Panel. The use of TPE functions is strongly recommended (refer to Switch Datalog Files Generation On/Off). Datalog enabling from Front Panel also enables datalog displaying, which significantly increases testing time.

Data Engine Connection to Kalos Datalog Stream

Datalog server/client architecture in Kalos 2 software version 1.9 and before provides a mechanism for capturing test datalog in binary format by several applications. Datalog server/client is composed of two main components: Dlogserver application and a client application. The Dlogserver application captures all test datalog and sends it to the client application in binary format. The client application formats the binary test datalog sent from the Dlogserver. The client applications communicate with the Dlogserver through dlogclient.dll.

The Data Engine connects to datalog as a client application for Dlogserver. This is illustrated in Figure 215.

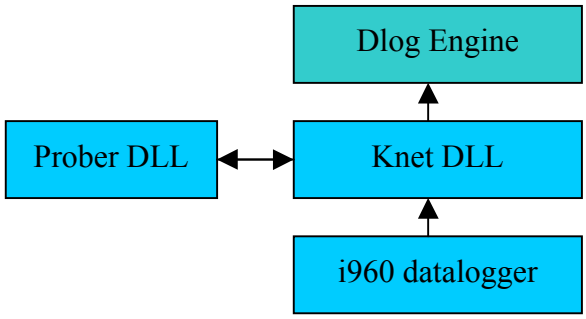
Figure 215. Datalog Architecture in Kalos 2 Software Versions 1.9 and Before



Dlog Engine Connection to Kalos Datalog Stream

The Dlogserver is not a separate application in Kalos 2 software. Dlogserver functionality is included in the Dlog Engine, which connects directly to the Kalos 2 datalog stream. This is illustrated in Figure 216.

Figure 216. Datalog Architecture in Kalos 2 Software



Data From Prober DLLs

DE receives information from prober DLL through datalog that includes:

- Lot name.
- Wafer name.
- Disposition of the devices on the wafer.
- Wafer geometry.

It also receives information about major process events:

- Start wafer.
- End wafer.
- End lot.

Use of Runtime Decode Strings and STDF.ini

The intent of runtime decode strings is to pass values of custom defined variables to DE from any application integrated with Kalos 2 core software. They are passed as a structure STATIC_LOOKUP_UMSG that has two strings:

- Key (identifier) of variable.
- Value of variable.

Values for these variables can be received and used by the DE and its DLLs. To use this feature from custom DLLs refer to Runtime Decode String Functions. This method is used to fill in applicable STDF fields.

Some prober DLLs perform runtime decode string generation, which is passed to Data Engine for several STDF fields. Dlog Engine includes that function and does not require such DLLs. Data is read (for sending) from the STDF.ini file. Parsing is performed at program loading.

STDF.ini must reside in the same directory as the KBI file. Refer to the sample of STDF.ini in the \Test\data_engine directory of the DE install. Each section of that file contains values for STDF record with the same name. Users can enter information into required fields for generating STDF files by writing values in STDF.ini. Refer to the following example.

```
[ATR]
cmd_line   =

[MIR]
job_nam   =
job_rev    =
sblot_id   =
oper_nam =
node_nam =
etc.
```

Test Program Modifications for Data Collection

Modifications include switching datalog on/off, selective datalog file generation, storing ASCII strings in the datalog files, putting C-Hook computed data into the datalog files, and assigning a unique test number to each test.

Switch Datalog Files Generation On/Off

It is typically necessary to generate datalog data for every test in the test flow in the production environment. In this case datalog must be switched on at the very start of the test program. This can be accomplished by using the KTL EVENT_MAP:

```
EVENT_MAP generic = {
   // STARTLOT = start_lot;
   // STARTWFR = start_wafer;
   STARTTEST = start_test;
   // ENDTEST = save_dies_bin;
   // ENDWFR = save_end_of_wafer;
   // ENDLOT = save_end_of_wafer;
   };
```

For this purpose STARTTEST event is used in the EVENT_MAP:

```
TEST start_test = {
   SEQUENCE = { dlog_on };
   };
```

The *start_test* executes a C-Hook that must be defined in a separate C file. In this example, the following C file is named *datalog.c*:

```
/* datalog.c - C module */
#include <chook.h>
RESULT dlog_on(void)
{
   TPEDatalogOn();
   return PASS;
}
RESULT dlog_off(void)
{
   TPEDatalogOff();
   return PASS;
}
```

This C-Hook consists of two functions: dlog_on() enables STDF data generation and dlog_off() disables it. This is accomplished using the TPE functions, TPEDatalogOn() and TPEDatalogOff().

This file must be defined as a CMODULE in the ktl test program:

```
CMODULE utils = {dlog_on, dlog_off };
```

The example above automatically enables the datalog information at the start of the test program and it stays switched on during the entire test flow. By switching the datalog *on* with the TPEDatalogOn() function, the datalog stream passes to the DE. The system automatically makes a decision as to whether it is dealing with a parametric, functional, or user test. The data ends up respectively in the PTR, FTR, or DTR record. For a full description of each of the STDF records, refer to the *Standard Test Data Format (STDF) Specification* manual. After receiving the datalog stream, DE can format the datalog information and put it into the STDF file format syntax. This is done automatically.

Selective Datalog Files Generation

For selective generation of datalog files, it is necessary to disable datalog for tests that are not to be logged. Leave datalog on for all other tests. Relevant KTL code to accomplish this scenario follows:

```
TEST Cont_io = {TESTNO=110; DESC = "This tests for continuity";
   SEQUENCE ={
         dlog_off,
         all_to_zero_seq,
         contact_pmu,
         MEAS(PMU),
         all_to_zero_seq,
         dlog_on
         };
ON_FAIL = { dlog_on };
   };
```

In the example above, dlog_off turns the datalog stream off at the beginning of the test and switches it back on at the end of the test sequence. The ON_FAIL sequence ensures that datalog is turned on even when the main sequence reaches a failing point.

HINT — Do NOT use the example below:

NOTE — The following is an example of code that should NEVER be used. This is due to the datalog being turned on, then off within a test. This is the WRONG way to do selective datalog.

Consider the following KTL test:

```
TEST Cont_io = {TESTNO=110; DESC = "This tests for continuity";
   SEQUENCE ={
         dlog_on,
         all_to_zero_seq,
         contact_pmu,
         MEAS(PMU),
         all_to_zero_seq,
         dlog_off
         };
   };
```

The above example can cause problems for the following reasons:

1. If the test passes, the next test may not be setup correctly, since the test name and test number are not passed to the DE, because datalog is disabled at the end of the test.
2. If the test failed, then results from the next test may be generated depending on a flow, because datalog is enabled.

NOTE — Typically the generation of the datalog files includes all tests, therefore, the method of switching on the datalog in the EVENT MAP is the preferred method.

Storing ASCII Strings in STDF File

DE can determine if a test is a functional test or a parametric test. According to that determination, the DE automatically stores the information in the FTR or PTR fields.

It is sometime necessary to insert a certain string into the STDF file, independent from the test name and test number. For example, this string may reflect information regarding a functional test. In this case, it is possible to use the STDF DTR (Data test Record) for this purpose. The TPEDatalogPrintf() function must be used to put an ASCII string into this DTR. DTR is generated every time this TPEDatalogPrintf() is used in the test program.

The *LOG_DTR* switch in kalos_production.ini enables/disables this feature.

NOTE — Not all STDF data analysis packages can read the DTR. If that is the case, refer to the following section (Putting C-Hook Computed Data Into the STDF File).

Putting C-Hook Computed Data Into the STDF File

The ability to judge a result is calculated in the C-Hook. This result is categorize as pass or fail using the TPEJudgeResult() function. This function only accepts the Value, LLim, and ULim as arguments and does not facilitate putting the result in the STDF file. However, there are scenarios to log multiple results in the STDF from the same test, with the same test name. In this scenario the TPE function, TPESetTestName (const char *name), must be used. Within a C-Hook, this allows for changing the test name just before executing the TPEJudgeResult() function. This distinguishes results coming from TPEJudgeResult() by giving the test a unique name, and to enable storage of multiple computed test results in separate STDF fields.

NOTE — Use caution when using TPESetTestName(). After the computed records are calculated, executed in the C-Hook, and logged in the STDF fields, it is critical to change the test name back to the name used in the flow.

Following is an example:

```
/* tpe_example.c */
#include <chook.h>
const REAL EXT_VX_START = 8.0;
const REAL EXT_VX_STOP = 5.5;
RESULT JudgeResult(void)
{
   ELEC meas, llim_elec, ulim_elec;
   LIMIT llim, ulim;
   /* assign variables for inserting STDF records */
   meas.volts = 1; meas.amps = 0; meas.secs = 0;
   llim_elec.volts = 1; llim_elec.amps = 0; llim_elec.secs = 0;
   ulim_elec.volts = 1; ulim_elec.amps = 0; ulim_elec.secs = 0;
   llim_elec.value = EXT_VX_START;
   ulim_elec.value = EXT_VX_STOP;
   ElecCpy(&(llim.limit), &llim_elec); llim.type = K_CHECK;
   ElecCpy(&(ulim.limit), &ulim_elec); ulim.type = K_CHECK;
   /* to ignore a limit use K_IGNORE instead of K_CHECK */
   TPESetTestName ("original_testname_1");
   TPEJudgeResult(&meas, &ulim, &llim);
   return PASS;
}
```

In this example, STDF logging is accomplished by using the EVENT MAP, which switches on the datalogging in the start and endtest section of the EVENT_MAP.

NOTE — For additional information on TPEJudgeResults and TPESetTestName use, refer to the TPE API Reference chapter of the KITE Reference Manual, part number 071-0455-xx. Also, refer to the *View C-Hook Results in the Histogram* Application Note for detailed information on TPEJudgeResults.

Assigning a Unique Test Number to Each Test and Bin

Using the same test numbers for different tests is not restricted by KTL syntax. Test numbers and test names are also optional. Using the same hard or soft bin numbers is not restricted, although the current structure of Datalog and DE does NOT support this flexibility and refers to the tests and bins by their numbers. Using the same test number for different tests can however cause unpredictable results in generated files. Using the same hard and soft bin number for different bins can cause bin names in generated files, such as, *Hard_1* or *Soft_1* instead of real names. Therefore, it is up to users to ensure that the different tests in the test flow have unique/different test numbers.

DE can also create consecutive test numbers automatically. For example, there is a test in the KTL with test number 1000. In the test sequence of this test a C-Hook is called, which executes 10 PMU measurements inside a loop. This means the STDF file contains 10 PTR (parametric test records) records, 1000 –1009. Therefore, it is incorrect to have the following test in the test flow start with number 1001, because these values are overwritten by the C-Hook measurements of the test *trimming,* which is test number 1000.

Custom DLL Creation

This section provides information on how to create and implement custom DLLs.

Custom DLL Structure

Users can add custom DLLs to the DE. These DLLs must have a specific structure of exported functions in order to be correctly loaded and initialized by DE. A number of functions exported by main EXE can also be called. DE custom DLLs are event driven.

Although DLLs for both Data Engine and Dlog Engine may have the exact same functionality, they are NOT interchangeable. The DLLs created for Data Engine must be recompiled with dlog_engine.lib before using with Dlog Engine.

Required Elements for Custom DLL Creation

The following elements are required for custom DLL creation.

- data_engine.lib or dlog_engine.lib are located in %KALOS_HOME%\lib.

- dlogex_types.h, data_engine_if.h, and kdx_if.h, kdx_tpe_dlog.h along with other standard Kalos include files are located in %KALOS_HOME%\include.
- Microsoft Visual C++ 6.

NOTE — This manual describes the creation of custom DLL with Microsoft Visual C++ 6. Usage of other compilers is not tested.

Custom DLL API Standard Functions

DE custom DLLs include the following exported functions:

```
kdx_return kdx_register_callbacks(void)      – mandatory
kdx_return kdx_initialize(void)              – optional
kdx_return kdx_shutdown(void)                – optional
```

kdx_return macro defines the function as a callback function, which returnsint type. Usually a 1 is returned.

These functions are called by DE EXE to perform specific actions.

kdx_initialize() is called at test program loading and can be used for DLL data initialization purposes, e.g., reading INI file settings.

kdx_shutdown() is called before DE closing, DLL unloading, and before kdx_initialize() at test program loading. It can be used to close the file generated by DLL.

kdx_register_callbacks() is called to register DLL callback functions with standard events (refer to Standard Event Functions) in DE. DE EXE calls registered functions when the event occurs:

```
bool kdx_add_callback(const type, char *CB_FuncName, const dlogType = 0 /
* MSG_EMPTY */);
```

where:

```
type          – type of the event
CB_FuncName   – name of the function to call
dlogType      – type of datalog message (only for datalog messages
                functions)
```

Standard Event Functions

Standard event functions are used to register functions using kdx_add_callback().

Registered functions must have *kdx_return* macro as a return value. Parameters of these functions are shown in Table 29.

Table 29. Standard Event Functions

Event	Description	Parameters	Description of Parameters
KDX_START_LOT	Start of lot	void	
KDX_START_WAFER	Start of wafer	void	
KDX_START_DEVICE	Start of device testing	int site	Site number
		int devNum	Device number
		int x	X coordinate
		int y	Y coordinate
KDX_DUT_TEST	Results of test execution	dutTestInfo *dti	DUT test information (refer to data_engine_if.h)
		void *uData	User data
		void *xyData	XY Data
KDX_END_DEVICE	Results of device testing	int site	Site number
		int devNum	Device number
		int hBin	Hardware bin
		int sBin	Software bin
		int ResFlag	Test result (refer to RESULT enum in ktypes.h)
		int inWafer	1 – in wafer 0 – not in wafer
		int x	X coordinate
		int y	Y coordinate
KDX_END_WAFER	End of wafer	void	
KDX_END_LOT	End of lot	void	
KDX_USER_PRINTF	TPEDatalogPrintf() is called in the test program	void	
KDX_END_SHMOO	Complete shmoo execution is finished	int site	Site number

NOTE — Not all of the function events are described in Table 29.

For example:

```
kdx_return kdx_register_callbacks(void)
{
```

```
    if ((kdx_add_callback(KDX_START_LOT,    "start_lot_trig")) ==
        false)
          return 0;
    if ((kdx_add_callback(KDX_START_WAFER,  "start_wafer_trig")) ==
        false)
          return 0;
    …

return 1;
}
```

Any user-defined name can be used for the function instead of *start_lot_trig*, *start_wafer_trig*, etc. These functions must however include arguments and a return value for each type of event.

Exported Functions of DE EXE

Some custom DLLs have the ability to call functions exported by the DE EXE. As described above, kdx_add_callback() is an example of such a function. These functions are declared in the data_engine_if.h and are implemented in the DE EXE. The result of this function call can be DLL specific or not. If the function is DLL specific, DE EXE determines from which DLL the function is called, and takes action specific to that DLL.

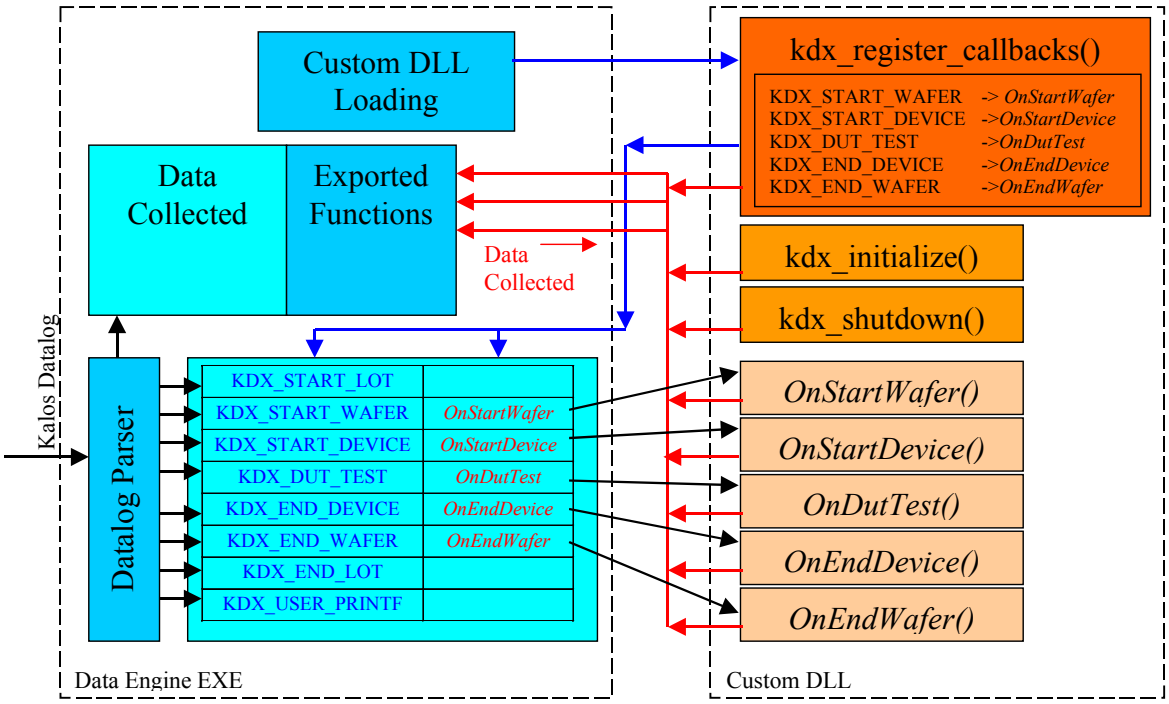
For example:

```
CString file_name = kdx_get_output_file();
CString prog_name = kdx_get_program_name();
…
kdx_runBatchFile((LPCTSTR) fname);
```

The first function returns a name for a file to be created by DLL, which is set in INI file. The second function returns the name of the test program. The third function processes a file after it is created by the postprocessor (refer to Postprocessor).

The result of the first function call is different for each DLL because created file names are different for each DLL. The result of the second function call is the same in all DLLs because the test program is the same for all DLLs. The third function does not return anything, but calls the postprocessor that was specified in the INI file using local overrides for that DLL.

Figure 217. Structure of Custom DLL



Custom DLL Generation

The following steps are necessary to create DE custom DLL with Microsoft Visual C++ 6 (VC++).

Configure Kalos Configuration Manager for VC++

VC++ session for custom DLL development must be run from Kalos Configuration Manager only. This is required to include all header and LIB files properly. For this purpose VC++ icon must be added to the Kalos Configuration Manager.

- In the Kalos Configuration Manager, select **Option|Customize...** menu and then select **Add Application...**
- Use the browser window to go to *C:\Program Files\Microsoft Visual Studio\Common\MSDev98\Bin*. A file called *msdev.exe* appears.
- Select the msdev.exe file and press OK. A new icon for VC++ appears in the Kalos Configuration Manager.

This step is required only once.

Create Project

The project for DLL must be created using **MFC AppWizard (dll)** template project.

- Run VC++ from Kalos Configuration Manager.
- Select **File|New...** from the VC++ menu and then **Projects** tab from opened dialog.
- Select **MFC AppWizard (dll)** template from the list.
- Enter the name for the custom DLL in **Project name** box and check project path in the **Location** box.
- Click the OK button.
- Select the **Regular DLL using shared MFC DLL** radio button.
- Press the Finish button, then the OK button.

Include Header Files

Kalos 2 and DE header file, kdx_if.h, must be included to get type and function declarations. Include the files at the main CPP project file, just after the automatically created *include* statements.

Setup Header Files Directory

The directory of the included header files must be set in the project's settings. These files are put in the *$(KALOS_HOME)\include* directory at DE installation. Here $(KALOS_HOME) is the environmental variable representing the Kalos 2 setup home directory. It is set in **KALOS HOME** box in the Kalos Configuration Manager.

- Select **Project|Settings...** from the VC++ menu to open the **Project Settings** dialog.
- Select **All Configurations** in the **Settings For** box.
- Select the **C/C++** tab in the **Project Settings** dialog, then select **Preprocessor** in the **Category** box.
- Enter $(KALOS_HOME)\include in the **Additional include directories** box.

Do not close the **Project Settings** dialog. It is necessary for the next step.

Set Linking with LIB File

Linking with Data Engine static library *data_engine.lib*, or Dlog Engine static library dlog_engine.lib must be set in the project's settings. This file is put into the $(KALOS_HOME)\lib directory at DE installation.

- Select the **Link** tab in the **Project Settings** dialog, then select **Input** in the **Category** box.

- Enter data_engine.lib in the **Object/library modules** box.
- Enter $(KALOS_HOME)\lib in the **Additional library path** box.

Do not close P**roject Settings** dialog. It is necessary for the next step.

Setup Output Directory

An output directory for the project must be set in the directory were a custom DLL resides. It is possible to specify any directory. Usually other DLLs of DE reside in $(KALOS_HOME)\Test\data_engine.

- Select the General tab in the **Project Settings** dialog.
- Enter the path in the **Output files** box.
- Press the OK button to close the **Project Settings** dialog.

It is possible to specify different paths for each configuration in the **Settings for** box.

Specify DLL in kalos_production.ini

The name of the custom DLL must be set in the kalos_production.ini to ensure the DE knows the custom DLL exists and where it is located. This path must correspond to the path in the project settings.

- Write the full name of DLL for the key *USER1_DLL* or *USER2_DLL* in the [DATA ENGINE] section of kalos_production.ini.

Use *$* for the path if DLL is in the default directory for DE DLLs or specify the full path. The default directory for DE DLLs is the directory specified for KDX_DLL_DIR key (refer to DE Global Settings).

For example:

```
USER1_DLL          = $\custom_test.dll
```

Here custom DLL *custom_test.dll* resides in the default directory.

Create DLL Section in kalos_production.ini

The section for DLL must be created in the kalos_production.ini to contain configuration settings for DLL. The [kdx_tpePrintf] section in the default kalos_production.ini can be used as a template.

- Copy the [kdx_tpePrintf] section to the end of file.
- Rename the section to the name of DLL without the .dll extension.
- Enter *true* for *ENABLED* to enable DLL.
- Enter the desired extension for created by DLL files in *FILE_EXTENSION*.

- Change filename settings in *FILENAME* and *WAFER_FILENAME* if necessary.
- Apply other local overrides if necessary (refer to DE Global Settings and Local Override Settings for DE DLLs).

For example, the section for custom_test.dll, which creates files with *cst* extension would be:

[custom_test]

ENABLED = true ; Can be [True | False | 1 | 0]

FILENAME = %machine_id%_%lotname%_%flow_id%_%time%

WAFER_FILENAME = %machine_id%_%lotname%_%flow_id%_%wafer_num=INT02%_%time%

FILE_EXTENSION = cst

Export Required Functions

Functions exported by the DLL must be created. These functions include DE DLL standard functions and functions registered for special events.

All exported functions must include the *kdx_return* macro instead of the return value. This macro defines these as callback functions, which return int type. Usually a 1 is returned.

- Create custom DLL API standard functions (refer to Custom DLL API Standard Functions).
- Create and register necessary for standard event functions (refer to Standard Event Functions).
- List all exported functions in the DEF file of the custom DLL project.

An example for registration of exported functions in CPP and DEF files follows (the implementation of registered functions is not shown):

custom_test.cpp

```
kdx_return kdx_register_callbacks(void)
{
// standard event functions
      if ((kdx_add_callback(KDX_START_LOT,
"start_lot_trig")) == false)
            return 0;
      if ((kdx_add_callback(KDX_START_WAFER,
      "start_wafer_trig")) == false)
            return 0;
return 1;
```

```
}

custom_test.def
kdx_register_callbacks
start_lot_trig
start_wafer_trig
```

Create Custom Code

Implement registered functions with code is required for created DLL. DLL can collect data during testing and create files at certain events, such as, end lot or end wafer. The data can be collected using parameters passed with registered functions, which are called by DE EXE. Data can be collected or DE EXE exported functions (refer to Exported Functions of DE EXE) can be called. The Postprocessor must process all created files. The kdx_runBatchFile() function is used for this purpose.

List of Exported Functions of DE EXE

The following is a list of DE EXE exported functions, which are declared in the data_engine_if.h. These functions are the main API functions to get information for DE DLL.

Data type definitions that are used in the functions follow:

- Standard C/C++ data types.
- DE specific types from data_engine_if.h.
- Kalos 2 software specific types from deviceif.h and ktypes.h.
- Pin assignment enums from nettypes_exp.h.

Functions marked with an '*' have DLL specific call.

Common Functions

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_printf	Puts string to text dump file (refer to Collecting Log Files for Debugging)	int	Number of characters written
		char *format, ...	String format like for standard printf()

kdx_add_callback*	Register DE callback function for certain event (refer to Custom DLL API Standard Functions)	bool	True – Success False – Fail
		const type	Type of the event
		char *CB_FuncName	Name of the function to call
		const dlogType = 0	Internal use only
kdx_get_device_info	Gets device information by DI_DEVICE_INFO structure	bool	True – Success False – Fail
		DI_DEVICE_INFO *DI	Destination buffer for device info

Kalos Types Conversion to String

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_get_unit	Returns units string for ELEC structure like "V", "A^2", "Ohm" etc.	char *	Units string
		ELEC *elec	ELEC structure
kdx_getElecStr	Returns string representation for ELEC structure	const char *	ELEC string
		ELEC *elec	ELEC structure
kdx_getElecStr	Returns string representation for ELEC structure	const char *	ELEC string
		ELEC elec	ELEC structure
		char *elecStr	Destination buffer for ELEC string
kdx_getLimitStr	Returns string representation for LIMIT structure	const char *	LIMIT string
		LIMIT *limit	LIMIT structure
kdx_get_dlogtype_str	Returns string representation for “dlogtype” member in some datalog structures	char *	“dlogtype” string
		unsigned int dt	“dlogtype” value
kdx_get_vlogtype_str	Returns string representation for “vlog_type” member in DLOG_VLOG_MSG datalog structure	char *	“vlog_type” string
		int vt	“vlog_type” value

kdx_get_RESULT_str	Returns string representation for RESULT enum	char *	RESULT string
		RESULT r	RESULT enum
kdx_get_dev_info_type_str	Returns string representation for DI_DEVICE_TYPE enum	char *	DI_DEVICE_TYPE string
		DI_DEVICE_TYPE t	DI_DEVICE_TYPE enum
kdx_get_dev_info_testmode_str	Returns string representation for DI_TEST_MODE enum	char *	DI_TEST_MODE string
		DI_TEST_MODE t	DI_TEST_MODE enum
kdx_get_dev_info_ifType_str	Returns string representation for DI_INTERFACE_TYPE enum	char *	DI_INTERFACE_TYPE string
		DI_INTERFACE_TYPE t	DI_INTERFACE_TYPE enum
kdx_get_dev_info_flat_str	Returns string representation for DI_WAFER_FLAT enum	char *	DI_WAFER_FLAT string
		DI_WAFER_FLAT t	DI_WAFER_FLAT enum
kdx_get_dev_info_origin_str	Returns string representation for DI_WAFER_ORIGIN enum	char *	DI_WAFER_ORIGIN string
		DI_WAFER_ORIGIN t	DI_WAFER_ORIGIN enum
kdx_get_dev_dieConfig_str	Returns string representation for DI_DIE_CONFIG enum	char *	DI_DIE_CONFIG string
		DI_DIE_CONFIG t	DI_DIE_CONFIG enum

Device Pin Assignment Information

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_getNumDpins	Returns number of device pins in socket table	int	Number of device pins
		void	
kdx_getDutsPerModule	Returns number of DUTs (sites) per module	int	Number of sites
		void	

kdx_get_pintype_str	Returns string representation for "pintype" and "pintype_exp" members in DPIN datalog structure	const char *	Pin type string
		int ref	Pin type number in PINTYPE enum from “nettypes_exp.h”
kdx_get_pinassign_str	Returns string representation for "assign" and "assign_exp" members in DPIN datalog structure	const char *	Pin assignment string
		int ref	Pin assignment number in PIN_ASSIGN_TYPE enum from “nettypes_exp.h”
kdx_getDpinEntry	Gets info for specified device pin	bool	True – Success False – Fail
		int entry	Number of device pin to get info
		int *numChan	Destination buffer for number of channels connected to pin
		int *chan	Destination array of connected channels numbers. Size of array must be [MAX_DLOG_MOD_SITES]
		char *pinName	Destination buffer for pin name string
		char *pinType	Destination buffer for pin type string
		char *assign	Destination buffer for pin assignment string
		char *pinType_exp	Destination buffer for pin alt type string
		char *assign_exp	Destination buffer for pin alt assignment string

General InformationD

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_get_program_name	Gets test program name	const char *	Test program name string
		char *buf = NULL	Destination buffer for test program name
kdx_get_device_name	Gets device name	const char *	Device name string
		char *buf = NULL	Destination buffer for device name
kdx_get_flow_id	Gets flow ID	const char *	Flow ID string
		char *buf = NULL	Destination buffer for flow ID
kdx_get_lot_id	Gets lot ID	const char *	Lot ID string
		char *buf = NULL	Destination buffer for lot ID
kdx_get_operator_id	Gets operator ID	const char *	Operator ID string
		char *buf = NULL	Destination buffer for operator ID
kdx_get_user_text	Gets user text from Front Panel	const char *	User text string
		char *buf = NULL	Destination buffer for user text
kdx_get_user_comment	Gets user comment from Front Panel	const char *	User comment string
		char *buf = NULL	Destination buffer for user comment
kdx_get_machine_id	Gets machine ID	const char *	Machine ID string
		char *buf = NULL	Destination buffer for machine ID
kdx_get_tester_id	Gets tester ID, which is same as machine ID	const char *	Tester ID string
		char *buf = NULL	Destination buffer for tester ID
kdx_get_tester_type	Gets tester type like "KalosXP", "Kalos48" or "Kalos2"	const char *	Tester type string
		char *buf = NULL	Destination buffer for tester type
kdx_get_wafer_id	Gets wafer ID, which includes lot ID, wafer number and checksum	const char *	Wafer ID string
		char *buf = NULL	Destination buffer for wafer ID

kdx_get_part_type	Gets part type	const char *	Part type string
		char *buf	Destination buffer for part type or NULL
kdx_get_wafer_num	Gets wafer number	int	Wafer number
		void	

Time and Date Information

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_get_time_str	Returns string representation for current Time/Date	const char *	Current Time/Date string
		const char *fmtStr = "%b_%d_%Y_%H%M%S"	Time/Date format like for strftime() standard C function
kdx_get_start_time_str	Returns string representation for lot start Time/Date	const char *	Lot start Time/Date string
		const char *fmtStr = "%b_%d_%Y_%H%M%S"	Time/Date format like for strftime() standard C function
kdx_get_finish_time_str	Returns string representation for lot finish Time/Date	const char *	Lot finish Time/Date string
		const char *fmtStr = "%b_%d_%Y_%H%M%S"	Time/Date format like for strftime() standard C function
kdx_get_start_wafer_time_str	Returns string representation for wafer start Time/Date	const char *	Wafer start Time/Date string
		const char *fmtStr = "%b_%d_%Y_%H%M%S"	Time/Date format like for strftime() standard C function
kdx_get_wafer_finish_time_str	Returns string representation for wafer finish Time/Date	const char *	Wafer finish Time/Date string
		const char *fmtStr = "%b_%d_%Y_%H%M%S"	Time/Date format like for strftime() standard C function

kdx_get_start_device_time_str	Returns string representation for device start Time/Date	const char *	Device start Time/Date string
		const char *fmtStr = "%b_%d_%Y_%H%M%S"	Time/Date format like for strftime() standard C function
kdx_get_device_finish_time_str	Returns string representation for device finish Time/Date	const char *	Device finish Time/Date string
		const char *fmtStr = "%b_%d_%Y_%H%M%S"	Time/Date format like for strftime() standard C function
kdx_get_time	Returns current Time/Date	time_t	Current Time/Date
		void	
kdx_get_start_lot_time	Returns lot start Time/Date	time_t	Lot start Time/Date
		void	
kdx_get_finish_lot_time	Returns lot finish Time/Date	time_t	Lot finish Time/Date
		void	
kdx_get_start_wafer_time	Returns wafer start Time/Date	time_t	Wafer start Time/Date
		void	
kdx_get_wafer_finish_time	Returns wafer finish Time/Date	time_t	Wafer finish Time/Date
		void	
kdx_get_start_device_time	Returns device start Time/Date	time_t	Device start Time/Date
		void	
kdx_get_device_finish_time	Returns device finish Time/Date	time_t	Device finish Time/Date
		void	
kdx_getTestTime	Returns elapsed test time for device	unsigned long	Test time in msec
		int site	Kalos DUT site number
kdx_get_time_diff	Returns elapsed time from reference time	long	Time in msec
		struct _timeb tb	Reference time

Device Number and Site Information

Kalos DUT site number, used in the following functions, is calculated by the formula:

Kalos DUT site = module * (DUTs per module) + (DUT site on this module),

where modules range from 0 to (number boards in system - 1) and DUT sites range from 0 to (number DUTs per board - 1).

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_get_current_site	Returns the number of site, to which current datalog data refers	int	Kalos DUT site number
		void	
kdx_get_device_number	Returns device sequence number in wafer for last device or for current device on specified site	int	Device sequence number in wafer
		int site = -1	Kalos DUT site number or –1 for last device
kdx_get_total_part_count	Returns total number of tested devices in wafer	int	Total number of tested devices in wafer
		void	
kdx_get_good_part_count	Returns total number of passed devices in wafer	int	Number of passed devices in wafer
		void	
kdx_get_lot_device_number	Returns device sequence number in lot for last device or for current device on specified site	int	Device sequence number in lot
		int site = -1	Kalos DUT site number or –1 for last device
kdx_get_lot_total_part_count	Returns total number of tested devices in lot	int	Total number of tested devices in lot
		void	
kdx_get_lot_good_part_count	Returns total number of passed devices in lot	int	Number of passed devices in lot
		void	
kdx_get_site_info	Gets total number of active sites and puts their Kalos DUT site numbers into array	int	Total number of active sites
		int *sites	Destination array for Kalos DUT site numbers of active sites. Size of array must be [MAX_DLOG_SITES]

kdx_get_site	Returns Kalos DUT site number based on module number and site number on module	int	Kalos DUT site number
		int mod	Module number
		int site	Site number on module
		int phy_dut	Default Kalos DUT site number or –1

Bin Information

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_get_binName	Gets hardware or software bin name	char *	Bin name
		int binNum	Bin number
		char *buf	Destination buffer for bin name
		bool isSoftBin = true	True – Software bin False – Hardware bin
kdx_get_binNums	Gets total number of bins and puts their numbers into array	int	Total number of bins
		int *bins	Destination array for numbers of bins. Size of array must be [MAX_DLOG_BINS]
		bool isSoftBin = true	True – Software bin False – Hardware bin
kdx_get_bin_pf	Gets Pass/Fail type of bin	int	Integer representation of RESULT enum values
		int bin	Bin number
		bool isSoftBin = true	True – Software bin False – Hardware bin
kdx_get_bin_site_cnt	Returns number of devices in the wafer, which were tested by specified site and put to specified bin	int	Number of devices
		int site	Kalos DUT site number
		int bin	Bin number
		bool isSoftBin = true	True – Software bin False – Hardware bin

kdx_get_total_bin_cnt	Returns number of devices in the wafer, which were tested by all sites and put to specified bin	int	Number of devices
		int bin	Bin number
		bool isSoftBin = true	True – Software bin False – Hardware bin
kdx_get_bin_lot_site_cnt	Returns number of devices in the lot, which were tested by specified site and put to specified bin	int	Number of devices
		int site	Kalos DUT site number
		int bin	Bin number
		bool isSoftBin = true	True – Software bin False – Hardware bin
kdx_get_total_lot_bin_cnt	Returns number of devices in the lot, which were tested by all sites and put to specified bin	int	Number of devices
		int bin	Bin number
		bool isSoftBin = true	True – Software bin False – Hardware bin

Number of Tests Information

Test numbers, used in the following functions, are defined as:

- Base test number – number assigned to the test in the KTL.
- Auto test number – number assigned to the test by DE.

These numbers coincide if KTL is created by Assigning a Unique Test Number to Each Test and Bin.

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_getNumTests	Number of tests executed for device	int	Number of tests
		int site	Kalos DUT site number
kdx_getTestNum	Gets base and auto test numbers for specified site	int	Auto test number
		int site	Kalos DUT site number
		int *baseTnum = NULL	Destination buffer for base test number
kdx_getCurTestNum	Gets base and auto test numbers for current site	int	Auto test number
		int *baseTnum	Destination buffer for base test number

Work Environment Information

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_isWafer	Returns flag of wafer testing	bool	True if wafer test
		void	
kdx_inWafer	Returns flag of wafer testing	bool	True if currently testing a wafer, False if between wafers
		void	
kdx_isK2	Returns type of tester: Kalos 1 or Kalos 2	bool	True – Kalos 2 False – Kalos 1
		void	
kdx_isK96	Returns type of tester: Kalos96 or Kalos48	bool	True – Kalos96 False – Kalos48
		void	
kdx_isProduction	Returns type of test mode	bool	True – Production False – Engineering
		void	
kdx_isMultisite	Returns flag of testing by multiple sites simulteniously	bool	True – Multisite False – Single site
		void	
kdx_useNTprofiling	Returns value of NT_PROFILING key in INI file	bool	True – Use False – Don't use
		void	
kdx_getProdProfile	Returns value of NT_PROD_NAME key in INI file	char *	Username for production mode
		void	
kdx_get_userName	Returns current username	const char *	Current username
		char *buf = NULL	

Output/Destination Files

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_get_output_file*	Returns full path of output file	const char *	Output file path
		void	

kdx_get_destination_file*	Returns full path of destination file	const char *	Destination file path
		void	
kdx_get_output_dir*	Returns directory for output file	const char *	Output file directory
		void	
kdx_get_destination_dir*	Returns directory for destination file	const char *	Destination file directory
		void	
kdx_runBatchFile*	Runs postprocessor for specified file (default postprocessor moves output file to destination file)	bool	
		const char *fileName	File to postprocess

Device XY Coordinates Information

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_get_min_x	Returns minimal X coordinate of device on wafer	int	Minimal X coordinate
		void	
kdx_get_max_x	Returns maximal X coordinate of device on wafer	int	Maximal X coordinate
		void	
kdx_get_min_y	Returns minimal Y coordinate of device on wafer	int	Minimal Y coordinate
		void	
kdx_get_max_y	Returns maximal Y coordinate of device on wafer	int	Maximal Y coordinate
		void	

kdx_get_xy_info	Gets device testing results based on device XY coordinates on the wafer	bool	True – Success False – Fail (device not tested yet)
		int x	X coordinate of device
		int y	Y coordinate of device
		int *sbin	Destination for software bin number or NULL
		int *hbin	Destination for hardware bin number or NULL
		int *site	Destination for site number on module or NULL
		int *dieNum	Destination buffer for device sequence number or NULL
kdx_get_xy_uNode	Multi node data for x, y location. Refer to multiwafermap for an example.	void *	Pointer to XY node
		int x	X coordinate of device
		int y	Y coordinate of device

Runtime Decode String Functions

The general parameter for runtime decode string functions is a key string, which is defined as:

Runtime key of string – key of string, received from Kalos 2 datalog with structure of STATIC_LOOKUP_UMSG type.

Key of string in INI – key of string in kalos_production.ini file, which is used for connects.

For example, the use of these functions for STDF atr.cmd_line field filling by runtime decode strings is:

```
kalos_production.ini

atr.cmd_line    = %program_name%_%job_revision%
DE EXE

// stat_lookup is STATIC_LOOKUP_UMSG type structure,
// Sets values of "program_name" and "job_revision"
```

```
// Called each time STATIC_LOOKUP_UMSG received from datalog
kdx_add_string_value((LPCTSTR) stat_lookup.key,
                     (LPCTSTR) stat_lookup.value);
                    // added per dll
DE DLL

// Connects "atr.cmd_line" with %program_name%_%job_revision%
from INI
// If "atr.cmd_line" does not exist in INI file, connects it
with "%program_name%"
// Called only once
kdx_return kdx_initialize(void)
{
    kdx_add_runtime_str("atr.cmd_line", "%program_name%");
    return 1;
}
// Gets value of "atr.cmd_line" which is runtime value of
// %program_name%_%job_revision%
// Called at each STDF file creation
void get_atr_cmd_line(char* atr_cmd_line)
{
    atr_cmd_line = kdx_get_runtime_str("atr.cmd_line");
// sets latiest value
}
```

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_add_runtime_str*	Connects key in INI file with runtime key of string	const char *	Current value of runtime decode string
		const char *key	Key of string in INI
		const char *defaultValue	Default runtime key of string
kdx_get_runtime_str*	Gets runtime decode string value based on the key in INI file	const char *	Current value of runtime decode string
		const char *key	Key of string in INI
kdx_add_string_value	Adds runtime decode string with specified runtime key	const char *	Current value of runtime decode string
		const char *key	Runtime key of string
		const char *buf	String to add
kdx_remove_string_value	Removes runtime decode string	bool	True – Success False – Fail
		const char *key	Runtime key of string

kdx_get_string_value	Gets runtime decode string value based on the runtime key	const char *	Current value of runtime decode string
		const char *key	Runtime key of string

Kalos_production.ini Parsing Functions

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_get_kpi_bool*	Gets bool value from INI file, considering local overrides	int	1 – true 0 – false –1 – failed
		const char *entry	Key name in INI
kdx_get_kpi_int*	Gets int value from INI file, considering local overrides	bool	True – Success False – Fail
		const char *entry	Key name in INI
		int *val	Destination buffer for int value
kdx_get_kpi_float*	Gets float value from INI file, considering local overrides	bool	True – Success False – Fail
		const char *entry	Key name in INI
		float *val	Destination buffer for float value
kdx_get_kpi_static_str*	Gets string value from INI file, considering local overrides	bool	True – Success False – Fail
		const char *entry	Key name in INI
		char *buffer	Destination buffer for string value

Test Trigger Functions

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_set_trigger_test_numbers*	On trigger test data will contain valid user data	bool	
		int numTrigs	
		int *TrigNums = NULL	
		bool useAutoNums = false	

kdx_is_tNum_trigger	Used for histogramming, test number log, etc.	bool	
		int *index	

Test Execution Information

Functions kdx_get_parametric_data() and kdx_get_functional_data() can be called at the KDX_DUT_TEST to get results of the test execution in ParamData and FuncData structures, respectively.

These structures are declared in the data_engine_if.h file. The record fields have the same purpose as STDF records PTR and FTR. “isValid” flag field is different from STDF and represents valid fields in the structures. Bit flag macros are also defined in the data_engine_if.h.

For example to get vector name for functional test:

```
FuncData *pFuncData = kdx_get_functional_data();
if(pFuncData->isValid & VECT_NAM_VALID)
      set_vect_nam(pFuncData->vect_nam);
```

Function Name	Description	Return Value / Parameters	Description of Return Value / Parameters
kdx_get_current_testName	Gets test name for last executed test	const char *	Test name
		void	
kdx_get_pattern_name	Gets pattern name for last executed functional test	const char *	Test pattern name
		char *name	Destination buffer for test pattern name
kdx_get_num_testNodes	Scan through	int	
		void	
kdx_getIndexed_testNodeInfo	All test execution info	testNodeInfo *	
		int idx	
		int site = -1	
kdx_get_parametric_data	Gets results of parametric test execution	ParamData*	Pointer to parametric test results structure
		void	
kdx_get_functional_data	Gets results of functional test execution	FuncData*	Pointer to functional test results structure
		void	

kdx_get_shmoo_header	Gets buffered shmoo header	ShmooHeader*	Pointer to shmoo header data structure
		int site	Site number
kdx_get_shmoo_data	Gets buffered data for one line in shmoo graph. Next call returns next line data	ShmooData*	Pointer to structure of data for one line in shmoo graph
		int site	Site number

Example Code Listing

The code example below creates a custom DLL (wafer_summary.dll) for hardware bins summary file generation at the end of wafer.

For example:

```
Tester ID   : KALOS-VAGHINAK
Tester Type : Kalos48
Interface   : TEL P8
Date        : 06 Aug 2002, 15:54:22
Program     : A5C0
Device      : A5C0
Flow        : s00_1ews_k
Lot         : A219568
Wafer ID    : A219568-25G6
Wafer Num   : 25
Operator    : Vaghinak
User Text   : ..comment..
Users_C     : ..user message..
Site        : CREDENCE_US
Tested:    1062 Passed:     820  77.21% Failed:     242  22.79%

Categories
Sort# Name          K00     K01     K02     K03   Totals Percent
  00P Bin_good_      91     102      97      79      369  34.75%
  01P Hard_1         98     115     121      80      451  42.47%
  02F Hard_2         13      17      10      15       55   5.19%
  03F Hard_3         17      22      21      18       78   7.32%
  04F Hard_4         23      35      29      22      109  10.28%
End
```

The files in project, which do not require manual changes, are not listed.

kalos_production.ini

```
[DATA ENGINE]
…
USER2_DLL              = $\wafer_summary.dll
…

[wafer_summary]
ENABLED                = true       ; Can be [ True | False | 1 | 0 ]

FILENAME               = %machine_id%_%lotname%_%flow_id%_%time%
WAFER_FILENAME         =
%machine_id%_%lotname%_%flow_id%_%wafer_num=INT02%_%time%
FILE_EXTENSION         = wsm
TEST_SITE        = CREDENCE_US
```

wafer_summary.def

```
LIBRARY      "wafer_summary"
DESCRIPTION  'wafer_summary Windows Dynamic Link Library'

EXPORTS
   ; Explicit exports can go here
            kdx_register_callbacks
            kdx_shutdown
            wafer_summary_report
```

wafer_summary.cpp

```
#include "stdafx.h"
#include "wafer_summary.h"

// Include DE header files
#include <kdx_if.h>

#ifdef _DEBUG
#define new DEBUG_NEW
#undef THIS_FILE
static char THIS_FILE[] = __FILE__;
#endif

/////////////////////////////////////////////////////////////////////////////
// CWafer_summaryApp

BEGIN_MESSAGE_MAP(CWafer_summaryApp, CWinApp)
            //{{AFX_MSG_MAP(CWafer_summaryApp)
```

```
                    // NOTE - the ClassWizard will add and remove mapping macros here.
                    //    DO NOT EDIT what you see in these blocks of generated code!
        //}}AFX_MSG_MAP
END_MESSAGE_MAP()

/////////////////////////////////////////////////////////////////////////////
// CWafer_summaryApp construction

CWafer_summaryApp::CWafer_summaryApp()
{
        // TODO: add construction code here,
        // Place all significant initialization in InitInstance
}

/////////////////////////////////////////////////////////////////////////////
// The one and only CWafer_summaryApp object

CWafer_summaryApp theApp;


// Code for DE DLL

#define  BUF_SIZE        256
#define  STRBUF_SIZE1024
#define PRINTSTR_SIZE132
#define  STR2HDR         ""

int wafer_summary_report(void);

// Register wafer_summary_report() function to be called at KDX_END_WAFER
int kdx_register_callbacks(void)
{
        if ((kdx_add_callback(KDX_END_WAFER, "wafer_summary_report")) == false) return 0;
        if ((kdx_add_runtime_str("test_site", "UNKNOWN")) == false) return 0;

        return 1;
}

// We are shutting down, make sure all summary reports are generated.
int kdx_shutdown(void)
{
        return wafer_summary_report();
}

// Called from DE EXE at the ane of wafer
```

```
int wafer_summary_report()
{
	CString fname;
	int site_ndx, hbin_ndx, bin_num;
	int num_hbins, hbin_nums[MAX_DLOG_BINS];
	int hbin_cnt = 0, cnt = 0;
	int num_tested, num_good, num_failed;
	int num_sites, site_nums[MAX_DLOG_SITES];
	char bufr1[BUF_SIZE], bufr2[BUF_SIZE], strbuf[BUF_SIZE];
	FILE *fp;
	int pf;
	char pfc;
	DI_DEVICE_INFO devInfo;

	// Before opening any file or generating a record, check that there are parts
	// tested, if not then just return.
	num_tested = kdx_get_total_part_count();
	if (num_tested == 0) {
		kdx_printf("kdx_summary not been generated as there are no devices tested.\n");
		return 1; // Even though there will be no summary file, this is a successful
			// return location, therefor return 1.
	}

	if (kdx_get_device_info(&devInfo) == false) return 0;

	fname = kdx_get_output_file();

	fp = fopen( (LPCTSTR) fname, "w+");
	if (!fp) {
		kdx_printf ("kdx_summary file '%s' open error\n", (LPCTSTR) fname);
		return 0;
	}
	kdx_printf("Opened summary file : %s\n", (LPCTSTR) fname);

	// Generate summary file header
	fprintf (fp, "Tester ID   : %s\n", kdx_get_machine_id());
	fprintf (fp, "Tester Type : %s\n", kdx_get_tester_type());
	fprintf (fp, "Interface   : %s\n", devInfo.model);
	fprintf (fp, "Date        : %s\n", kdx_get_start_wafer_time_str("%d %b %Y, %H:%M:%S"));
	fprintf (fp, "Program     : %s\n", kdx_get_program_name());
	fprintf (fp, "Device      : %s\n", kdx_get_device_name());
	fprintf (fp, "Flow        : %s\n", kdx_get_flow_id());
	fprintf (fp, "Lot         : %s\n", kdx_get_lot_id());
	if (kdx_isWafer()) {
		fprintf (fp, "Wafer ID    : %s\n", kdx_get_wafer_id());
```

```
            fprintf (fp, "Wafer Num   : %d\n", kdx_get_wafer_num());
}
fprintf (fp, "Operator    : %s\n", kdx_get_operator_id());
fprintf (fp, "User Text   : %s\n", kdx_get_user_text());
fprintf (fp, "Users_C     : %s\n", kdx_get_user_comment());
fprintf (fp, "Site        : %s\n", kdx_get_runtime_str("test_site"));

// Generate wafer summary
num_good = kdx_get_good_part_count();
num_failed = num_tested - num_good;
fprintf (fp, "Tested:%8d Passed:%8d %6.2f%% Failed:%8d %6.2f%%\n", num_tested,
 num_good,
            ((float)num_good / (float)num_tested) * 100.00, num_failed,
            ((float)num_failed / (float)num_tested) * 100.00);

// Generate Categories summary
strcpy(strbuf, "\nCategories\nSort# Name     ");
num_sites = kdx_get_site_info(site_nums);
for (site_ndx = 0; site_ndx < num_sites; site_ndx++) {
            sprintf (bufr1, "K%02d", site_nums[site_ndx]);
            sprintf (bufr2, "%8s", bufr1);
            if (strlen(strbuf) + strlen(bufr2) >= PRINTSTR_SIZE) {
                        fprintf (fp, "%s", strbuf);
                        strcpy (strbuf,STR2HDR);
            }
            strcat(strbuf, bufr2);
}
strcat(strbuf, "   Totals Percent\n");
fprintf (fp, "%s", strbuf);

// Generate hard bin summary
num_hbins = kdx_get_binNums(hbin_nums, false); // false = Not softBins.
for (hbin_ndx = 0; hbin_ndx < num_hbins; hbin_ndx++) {
            bin_num = hbin_nums[hbin_ndx];
            if ((hbin_cnt = kdx_get_total_bin_cnt(bin_num, false))!= 0) {
                        pf = kdx_get_bin_pf(bin_num, false); // false = Not softBins.
                        if (pf == PASS) pfc = 'P';
                        else if (pf == FAIL) pfc = 'F';
                        else pfc = 'U';
                        sprintf (bufr1, "  %02d%c", bin_num, pfc);
                        strcpy(strbuf, bufr1);
                        sprintf (bufr2, " %-10s", kdx_get_binName(bin_num, bufr1, false));
                        strncat(strbuf, bufr2, 10);
                        for (site_ndx = 0; site_ndx < num_sites; site_ndx++) {
                                    //
```

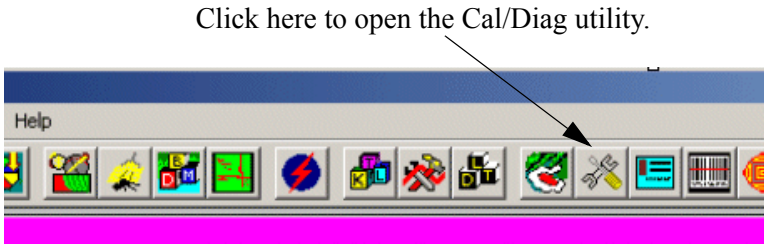
```
                                        // Get hard bin count
                                        //
                                        cnt = kdx_get_bin_site_cnt(site_nums[site_ndx], bin_num, false);
                                        sprintf (bufr1, "%8d", cnt);
                                        if (strlen(strbuf) + strlen(bufr1) >= PRINTSTR_SIZE) {
                                                fprintf (fp, "%s", strbuf);
                                                strcpy (strbuf,STR2HDR);
                                        }
                                        strcat(strbuf, bufr1);
                                }
                                //
                                // Get totals
                                //
                                sprintf (bufr1, " %8d", hbin_cnt);
                                strcat(strbuf, bufr1);
                                sprintf (bufr1, " %6.2f%%\n", ((float)hbin_cnt / (float)num_tested) *
                                    100.00);
                                strcat(strbuf, bufr1);
                                fprintf (fp, "%s", strbuf);
                        }
                }

                // End report
                fprintf (fp, "End\n");

                fclose(fp);

                // Run created file with postprocessor
                kdx_runBatchFile((LPCTSTR) fname);

                return 1;
}
```

Cal/Diag

The Kalos 2 tester is calibrated by running calibration/diagnostics from Front Panel. Calibration, beyond power supplies, is performed by software which requires no manual manipulation. In order to execute calibration, however, manual intervention is required to mount two types of load boards at various points in the process.

The Calibration/Diagnostics utility is launched by clicking on the *Cal/Diag* icon (see Figure 218) or it can be selected (launched) from the Utilities menu item.

Figure 218. Cal/Diag Icon



The Calibration programs are located in the directory C:\Kalos\bin. The calibration data is stored in the ETX on the tester. There may be other programs visible in the menu, however, they are not standard maintenance programs and should not be run without full understanding of the calibration software.

Refer to the Calibration and Diagnostics section in Chapter 4, *Introduction to KITE*, of this manual for calibration and diagnostics procedures.

ShowBitz Utility

ShowBitz is a Kalos 2 application debugging utility intended for the advanced user. It is designed to bypass the layers of software separating the user from the tester. It accesses the hardware directly, revealing how the tester is truly programmed.

ShowBitz provides an in-depth view into the Kalos 2 hardware. All functions of the tester are organized hierarchically, and all aspects of tester operation can be explored; channels can be studied, and registers can be read.

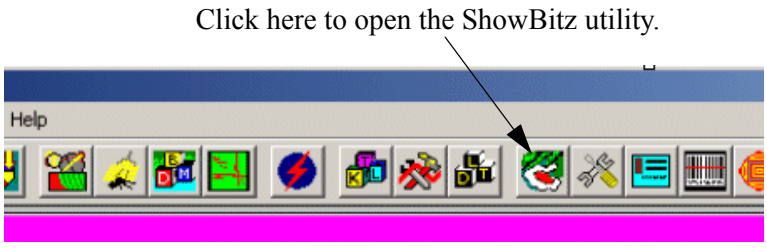
Equally important, ShowBitz has the ability to change the hardware. Most views in ShowBitz are interactive. Users have the option to choose an item from a list, or type in a new voltage, and the hardware is instantly changed and refreshed. Changes made using ShowBitz do not modify the test program and do not affect the test results (datalog, summary, etc.). When testing continues, changes made using ShowBitz are discarded, however, ShowBitz has a recording feature that allows the user to easily repeat any sequence of changes made using the interactive views. Two of the most basic functions of the Kalos 2 tester, pattern runs and parametric measurements, can also be performed using ShowBitz.

ShowBitz is suited for use throughout all phases of Kalos 2 development for debugging hardware, run-time software, diagnostics, GUI tools, and test programs. Because ShowBitz is not bound by the methodology of any test program, it can perform functions that cannot be performed any other way.

For detailed information on using the ShowBitz utility, click on the ShowBitz utility *Help* button and select *Reference Manual*.

The ShowBitz utility is launched by clicking on the *ShowBitz* icon (see Figure 219) or it can be selected (launched) from the Utilities menu item.

Figure 219. ShowBitz Icon



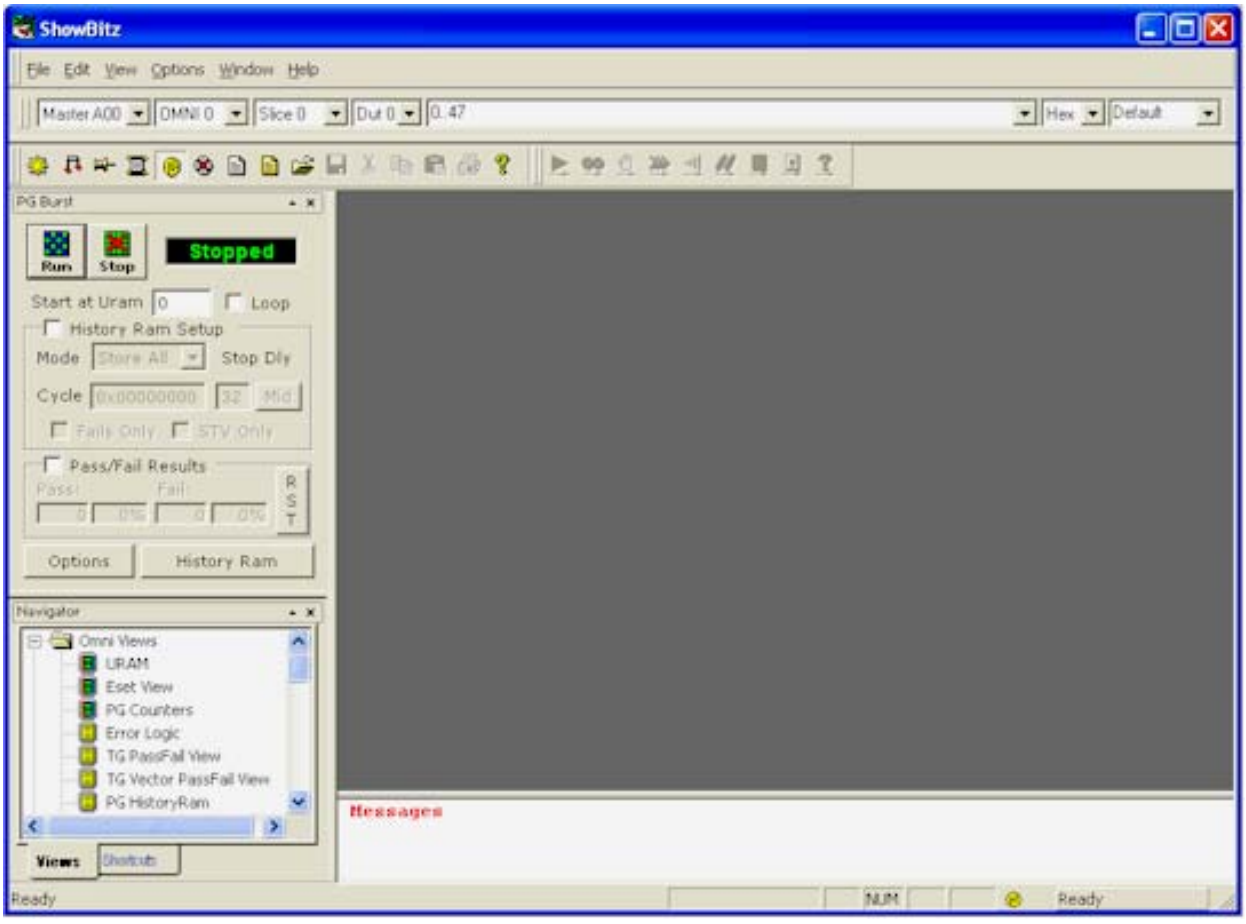
ShowBitz Interface

The ShowBits interface (main) window is shown in Figure 220. The ShowBitz utility comprises the following parts.

- Navigator

- Channel Views
- Omni Views
- Slice Views
- Register Views
- Protected Views
- Shortcuts Views
- Toolbars
- Send View
- Message Window

Figure 220. ShowBitz Interface Window



Navigator

The navigator is the first window that appears when the ShowBitz application is launched. An overview of the tester architecture is graphically presented, using a tree. Each branch of the tree represents a part of the Kalos 2 tester hardware. Clicking on an item in the Navigator launches a window that displays the registers of a part of the hardware. If such a window is already launched, but not visible, the navigator does not create a new window; it brings the existing window to the top of the window stack. To create another instance of a view (window), hold down the Shift key and click on the node in the tree.

The Navigator contains several classes of views. The class of a view can be distinguished by an icon image in the tree. A description of each class and an image, were applicable, of its icon are provided in the following sections.

Channel Views

Channel views show channel resources. The channels displayed are selected using the channel edit box on the ShowBitz toolbar or by using the Channel Selection Dialog. Channel views are interactive and allow users to instantly change the hardware with a point and click approach.

Omni Views

Omni views show registers in the Omni ASIC that are not channel related. The Omni selector on the ShowBitz toolbar selects which Omni ASIC is displayed. If ALL is selected, each Omni ASIC in the current slice mode is read back and compared. If values differ from one ASIC to another the value is shown with a red background. Omni views are interactive and allow users to instantly change the hardware with a point and click approach. When the Omni selector is set to ALL, entering a value changes all the Omni ASICs. Typically the Omni selector should be set to ALL.

Slice Views

Slice views show non-channel resources that are not part of the Omni ASIC. The slice selector on the ShowBitz toolbar selects which slice is displayed. Only one slice at a time can be viewed or modified. Slice views are interactive and allow users to instantly change the hardware with a point and click approach.

Register Views

Register views show the contents of a single tester register or related group of registers. The register views encompass every register in the tester. Registers are organized in the navigator exactly as they appear in Sierra, the bit chart viewer.

Protected Views

Other hardware views (windows) display the tester registers in a protected form. The hardware contents can be viewed, but not modified.

Shortcuts View

Similar to the navigator, the shortcuts view lists the names of interactive and protected views. A view can be launched by clicking on a name in the shortcuts view. Unlike the navigator which arranges the tester architecture in a tree, the Shortcuts view is a web linking the views together. All views can be linked together. There are hundreds of built-in links in ShowBitz. In addition, as the navigator is used to launch views, the old and new views are linked to each other.

Each view has its own shortcuts to other views. Whenever a view becomes active the shortcuts view changes to show the links for the active view.

Toolbar

The toolbar consists of three sections. Each section controls a different aspect of the program. This includes control of which Kalos 2 slot (slice) ShowBitz is attached to, which channels are displayed (only for Channel Views), the execution of Send scripts, and the record and replay feature.

Send View

The Send View is an environment for creating and running Send Scripts. A Send Script is a user-defined sequence of commands that manipulate the tester hardware. Built-in commands can read or write any register in the tester by name. For more complex operations, the Send Hardware Language (SHL) can be used. The Send View contains an interactive debugger for running Send scripts, setting breakpoints, single-stepping, looping, etc. Any operation that is performed using a Premier View can be performed using Send.

Message Window

Warnings and error messages from ShowBitz are displayed in this window.

Idrom

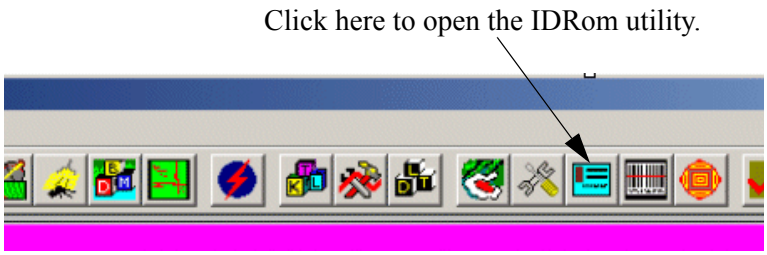
Each Kalos 2 board contains five serial electrically erasable non-volatile memories (Motherboard, PMU, DPS, EMU, and TCON for each of the two slices on the board). Each is called an IDROM. IDROM is an NVM memory chip which stores module information on each Kalos 2 board module. This information includes part number, revision number, etc.

In addition, each backplane in the test head contains an IDROM. Each IDROM contains formatted data identifying the manufacturer of the hardware and its capabilities. This information is programmed into the IDROM during the manufacture of the hardware. Each time the Kalos 2 test system is initialized, the IDROM data is retrieved and made available to all Kalos 2 boards and software. This information is used by Kalos 2 software to determine how to best utilize the hardware.

The Idrom utility is launched by clicking on the *IDRom* icon (see Figure 221) or it can be selected (launched) from the *Utilities* menu item.

For additional information on the Idrom utility, refer to the Idrom section of the Introduction to KITE chapter of this manual.

Figure 221. IDRom Icon



NVMDIB

The Non-Volatile Memory (NVM) on the Device Interface Board (DIB) is a small memory located on the test hardware that contains identification and configuration information needed by the test program.

NVMDIB is the readback of the current device interface board, IDROMs, if the user has implemented them.

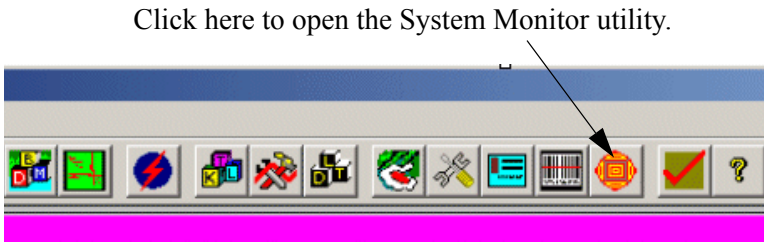
Detailed information on the NVMDIB utility is provided in the NVM User's Guide located under the Help menu of the NVMDIB utility. The NVMDIB has no relationship to the DIB Info.

System Monitor

The System Monitor monitors the electrical state of the tester system in terms of voltage, current, and temperature readings.

The System Monitor utility is launched by clicking on the *System Monitor* icon (see Figure 222) or it can be selected (launched) from the Utilities menu item.

Figure 222. System Monitor



The system monitor is started automatically when the Kalos 2 test system software is started (i.e., Ttarget/Kalos 2 server). It exits when Ttarget/Kalos 2 server is shutdown. Normally the System Monitor runs silently in the background, monitoring conditions in the test head. If an abnormal condition occurs, the System Monitor notifies Front Panel, which updates its message box in the top center of the program.

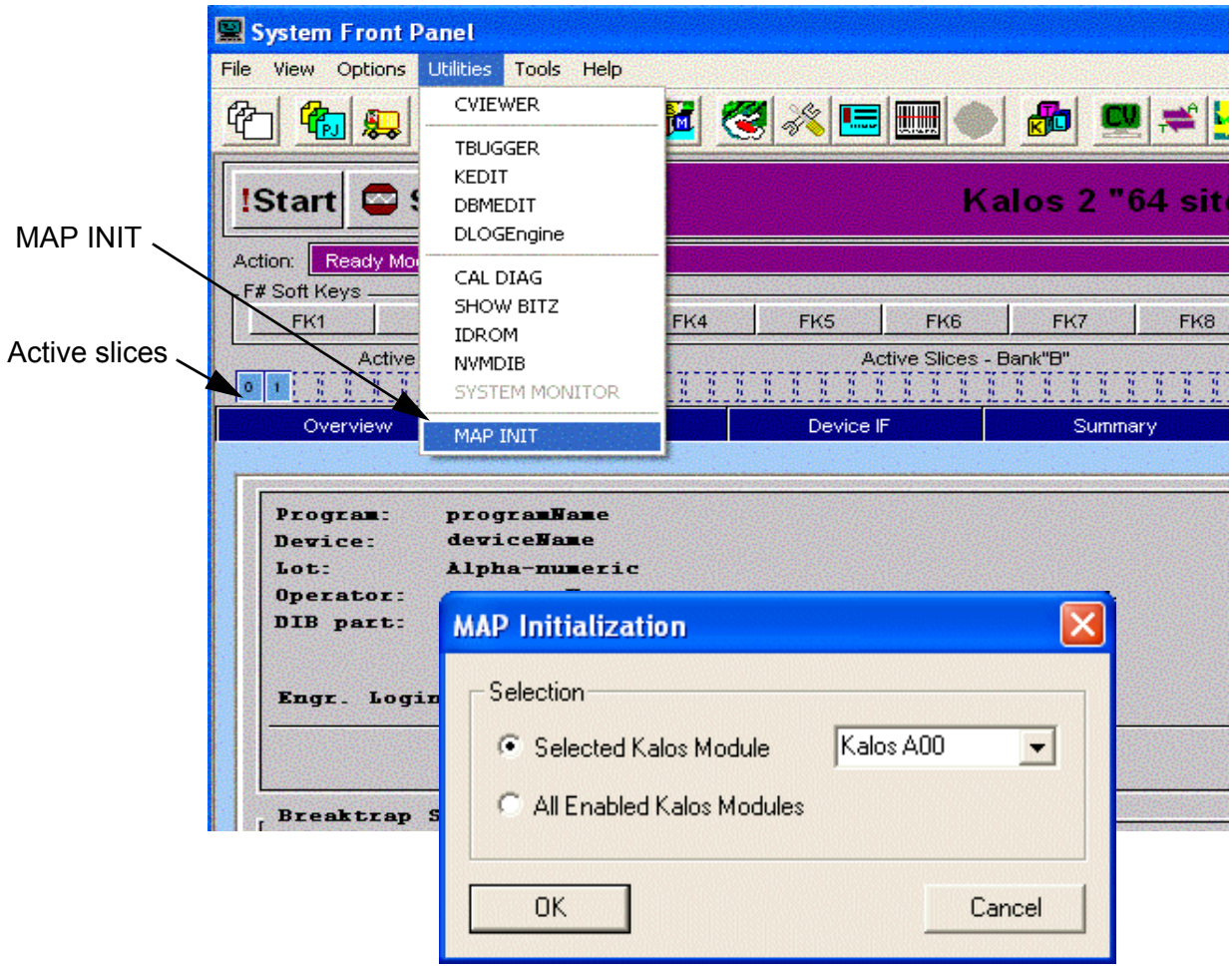
If a serious problem is detected the test head, the System Monitor can shutoff the test head power to prevent damage to the Kalos 2 test system hardware. If this occurs, Front Panel displays the message *Shutdown* in the main message box. A service technician should be called to investigate and correct the problem before system operation is restarted.

For additional information about the System Monitor, refer to the online *System Monitor User's Guide*. This user guide can be viewed by opening the System Monitor program from Front Panel and clicking the Help button on the toolbar.

MAP INIT

The MAP INIT selection brings up the MAP Initialization dialog box (see Figure 223) that allows the user to select all slices (most typical) or any one slice. To map the boards manually, click on the *Utilities* pulldown menu and select MAP INIT. Otherwise the interface automatically runs the mapping when the slice is set up by TTarget.

Figure 223. MAP INIT



6

TEST DEBUGGER

This chapter provides an introduction to the Test Debugger application. This interactive utility allows the user to modify test program components; including flow, sockets, tests, levels, and timing data, within a Kalos 2 test program and immediately return to program debugging without the need to re-compile.

Introduction

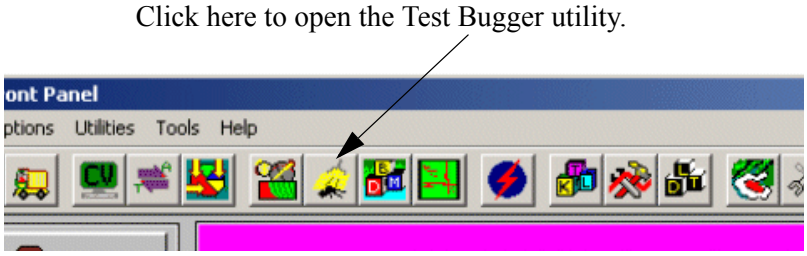
The Test Debugger (TBugger) utility provides the graphical user interface between the PC(XP) and the Kalos 2 tester. The interface is a collection of viewers and controls that allow the user to control, investigate, and change parameters of the Kalos 2 tester hardware using a device program test as the template.

With this utility, users are able to read back and change test data without the need to re-compile or reload the test program. It allows the flexibility needed for interactive creation and debugging of test programs while online. The effect of changes are seen immediately and turn around time for the creation of new test programs is reduced. Test Debugger uses the current test program as a template and requires a set breaktrap in Front Panel to read test components. Features of Test Debugger include the following:

- Both text and graphical viewing capabilities for flow, sockets, tests, levels, and timing data of the selected test at the specified break point.
- The ability to modify the specific components of the selected test.
- Linkage for support of other tools, such as Shmoo.
- Online operation capabilities only.

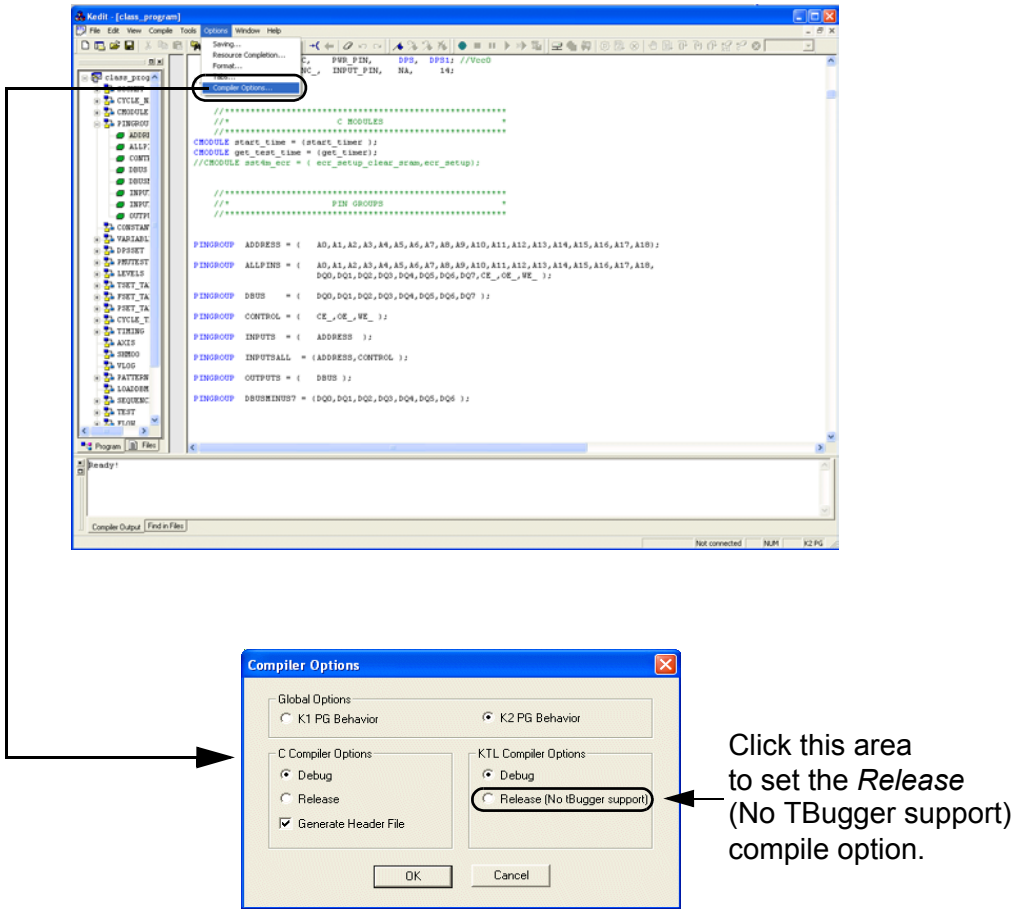
The Test Debugger utility is launched by clicking on the *Test Bugger* icon (see Figure 224) or it can be selected (launched) from the Utilities *TBUGGER* menu item.

Figure 224. Test Bugger Icon



A *Release* compile option, located in Kedit, restricts user access to the Test Debugger utility once a program is compiled. The Compile Options pulldown, chosen from the Kedit menu bar, is shown in Figure 225.

Figure 225. Compile Option Settings



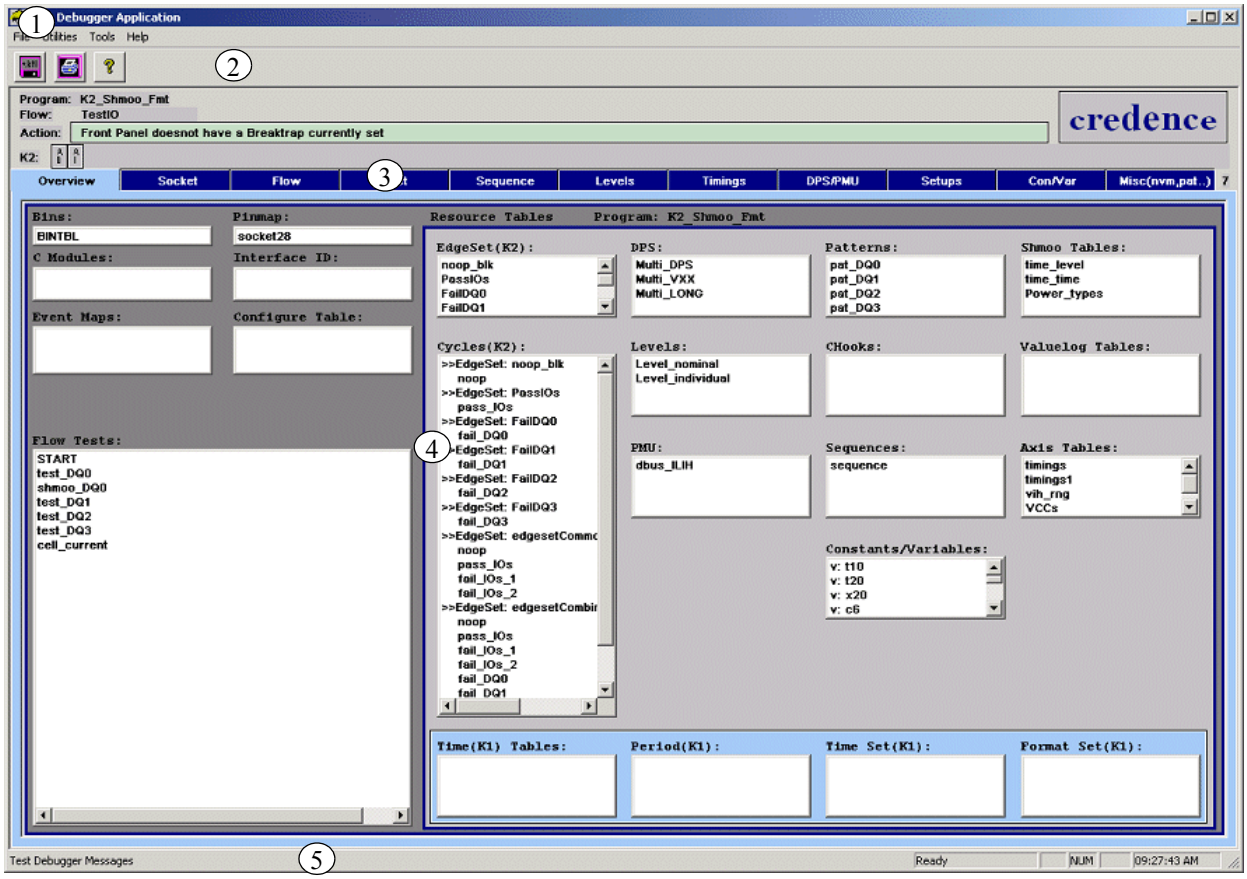
When this option is set, and the user brings up the Front Panel and logs into the Engineering Property page, the Test Bugger icon is grayed out, resulting in no test debugger access.

Graphical User Interface

The primary window (property page) display of the Test Debugger application is shown in Figure 226, This property page is subdivided into the following defined operational areas:

1. **Menu bar** - Interface for selecting the operations of the application.
2. **Toolbar icon** - Icon short cuts to the menu bar operations.
3. **Control area** - Select functional operations, controls, and a system monitor
4. **View area** - Tabbed views for selecting specific overviews with their respective components. Table and graphical views are available
5. **Status bar** - Displays messages and status.

Figure 226. Test Debugger Primary (Main) Window



Test Debugger Application

The Test Debugger utility is an application consisting of two modes of operation for its respective functions: Breaktrap or Selected. Breaktrap requires the Front Panel to set a breaktrap, thus enabling it to read (get) the current test components and allow for viewing and modification (set) of these components. Selected allows the selection of data and or table data from the loaded program for viewing and modification (set) of these components. Online mode of operation is the only mode available when using the Test Debugger.

All editing property pages have some common operations for getting, setting, and selecting the respective resource slice for editing. These operations are located in the property page's control area (top of the selected page).

The Get and Set buttons, if available for the respective property page, are used to update or send the Test Debugger current data table. Some of the property pages have an Apply button, which is a superior set operation. The Apply executes the set function and then applies the specific resource table to the Kalos 2 hardware.

The Break Test button, if available for the respective property page, allows the user to select a specific test (Break Test) or select a specific slice type for editing.

NOTE — Any restart of testing shows the effects of the modified slice resource. This is because the program was permanently changed.

In all table displays, the white areas are used for editing and the light-gray areas are not available for editing. The following is a description of the functionality of each property page. Refer to the specific property page sections in this chapter for detailed information.

Overview — Displays an overview of all programming slices of the loaded program. No editing operations are allowed on this property page.

Socket — A current file viewer. Displays the socket file of the loaded program. A sub-page (graphic) is available for viewing the device package of choice. No editing operations are allowed on this property page.

Flow — Allows for editing of the Bin and Flow tables of the loaded program. As with all table displays, the white areas are for editing and the light-gray areas are not available for editing. Three views are available on this page: Bin Table, Flow Table, and Flow Diagram.

Bin Table - The default view. The current Bin file is viewed here. This table represents the bin conditions, made up of a bin name, Sort

(Hard Bins), Counter (Soft Bins), and PASS/FAIL Designation.

Flow Table - Allows for editing of the Flow Table of the loaded program (white areas only).

Flow Diagram - A viewer that combines the Bin and Flow Tables and integrates them into a flow diagram.

Test — The selected test slice, which is determined by Select Test or Break Test (pointing to the highlighted text field), displays the overall block components or the element editing for the test components. The editing also includes the test identifiers and the sequence elements. Any modification to the test enables the Set button (yellow), which the user must activate if the modification is to be invoked in the program.

Sequence — In a similar manner to the Test property page, the Sequence page allows the user to edit the Sequence elements.

Levels — Allows for modification of all level values by either selecting an element from a pulldown list or by editing the text field.

Timings — Allows for modification of all timing values by either selecting an element from a pulldown list or by editing the text field.

DPS/PMU — Allows for modification of all DPS and PMU modes and values by either selecting an element from a pulldown list or by editing the test field.

Setups — Shmoo and Valuelog setup tables and expression sequence editors. Allows for modification of setup values by editing the respective text field (white area only).

Cons/Vars — (Constants and Variables) allows for modification of variable values or expressions by editing the respective text field (white areas only). Also displays the constants and their respective values, however, modifications to these areas are not allowed.

Misc(nvm,pat...) — Displays NVM loadboard data, pattern statement fail modes (which can be changed by way of the Patterns tab), and waveform (AWT) statement.

Primary Window (Overview) Functions

The following is a description of features contained within the main Test Debugger Application window. See Figure 227 for locations.

1. Application control button - Enables Windows pulldown menu for Test Debugger Application controls.
   - Restore -Returns to the previous applications window condition.
   - Move - Allows screen positioning of the application window.
   - Size - Enables resizing of the applications window.
   - Minimize - Icons the application and closes associated windows.
   - Maximize - Enlarges the application window to its maximum size.
   - Close - Shuts down the application and all associated windows.
2. Title bar

NOTE — Clicking the left mouse button in the title area enables direct window movement. Clicking the right mouse button launches the application control button dialog window.

3. Icon button - Minimizes the application window and shuts down all associated windows.
4. Maximize button - Enlarges the application window to its maximum allowed width and height.
5. Close button - Closes the Test Debugger Application GUI.
6. Menu bar - Interface for selecting the operations of the application.
   - File - Pulldown menu includes:

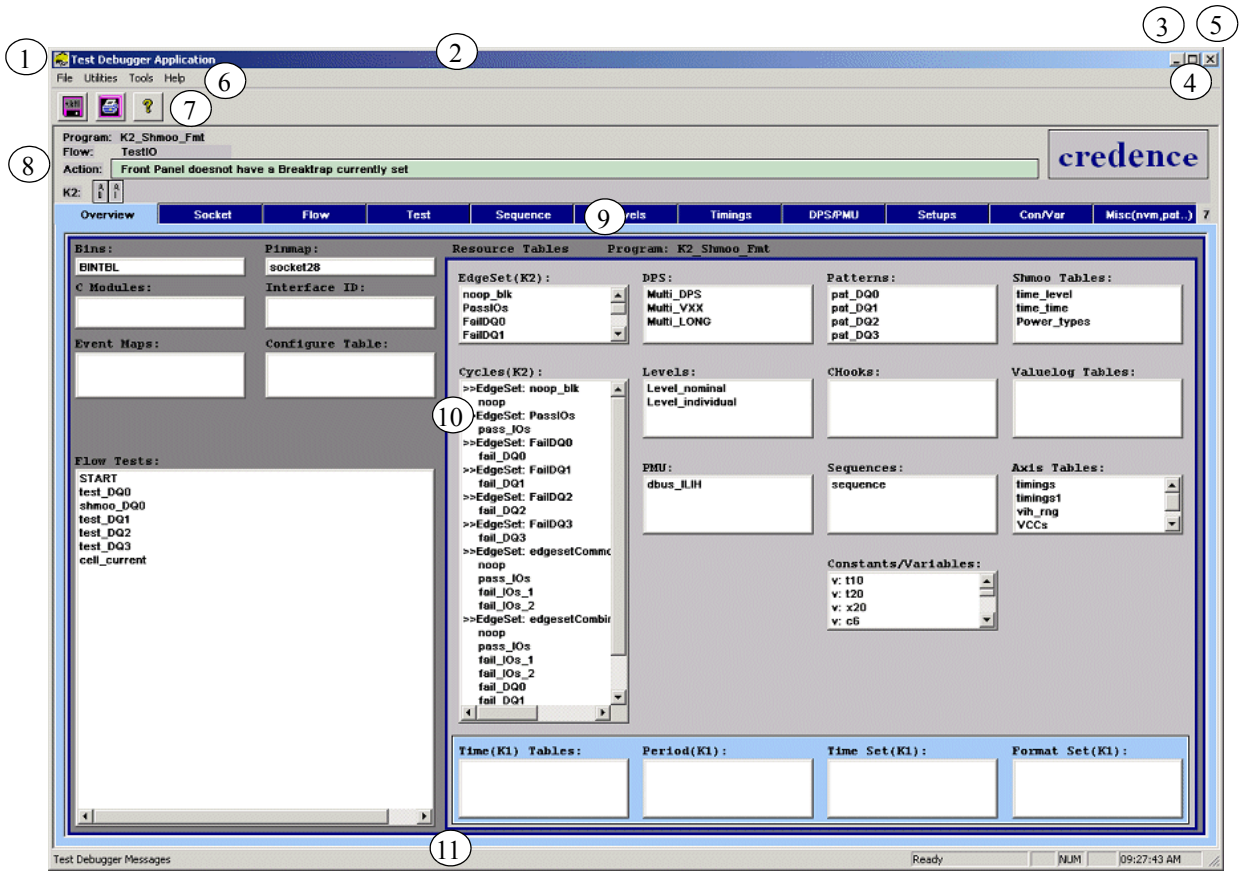
     SaveAs... - Saves the current debugging binary file (*.kbi) to a specified *.ktl file.

     Print tbugger_ktl... - Prints a hardcopy of the currently selected *.ktl program

     Exit - Closes the Test Debugger Application tool and all associated windows.
   - Utilities - pulldown menu
     Launches the selected utility application.
   - Tools - Pulldown menu
     Launches the selected tool application.
   - Help - About TBugger
     Displays the current revision information.

7. Toolbar icons - Consist of three graphical buttons (Save As, Print tbugger_ktl, and About) that when clicked send save and print commands, as do menus and keyboard accelerators, for requested functions of the Test Debugger utility. The Help button displays software version information (see Figure 228).
8. Program, Flow, and Action - Displays the current test program, flow the system is operating under, and Breaktrap condition.
9. Property page (tabs) - Functional page selection: functional operations, interface controls; display tables, charts, and graphs; timing information, and system monitoring.
10. View area - Views for selecting specific overviews with their respective components. Graphical views are available when required.
11. Status bar - Displays messages and status.

Figure 227. Overview (Primary Window)



Toolbar

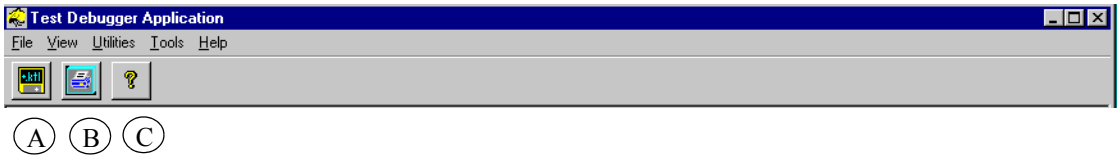
The Toolbar is an arrangement of three graphical icon buttons that when chosen execute commands. These buttons contain the most commonly used commands of the pulldown menu bar. The Toolbar comprises Save As, Print tbugger_ktl, and About buttons that when clicked send save and print commands, as do menus and keyboard accelerators, for requested functions of the Test Debugger utility, or display software version information. The following are definitions for the toolbar buttons shown in Figure 228:

a. SaveAs - saves the current debugging binary file (*.kbi) to a specified *.ktl file. The selected file, ASCII text, is the entire program de-compiled from the binary file that is currently loaded. No comments are saved with this command.

b. Print tbugger_ktl - allows the user to print a hardcopy of the currently selected *.ktl program (currently loaded). The entire program, de-compiled from binary to ASCII text, is sent to the selected printer.

c. About TBugger - launches a dialog window and displays the current version information.

Figure 228. Toolbar Icons



Property Page Functions

This section provides detailed descriptions on the functionality of each property page of the Test Debugger utility.

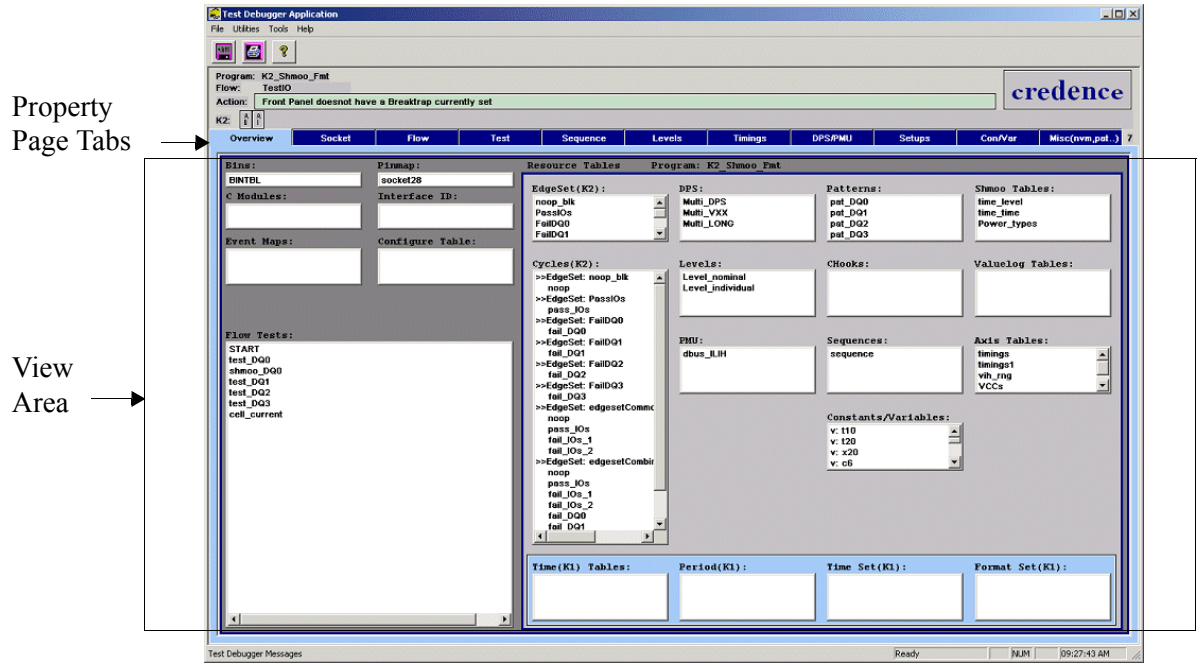
Overview Window

The Overview window (Test Debugger default window), as with all property pages, contains a row of property page tabs (see Figure 229) which open specified property pages. Each property page contains information regarding values set for a particular function of the Kalos 2 hardware and the current test program. Property pages display data in a text table format, some of the pages include a graphical representation. These views are designed for interfacing between the XP (non-real time) and the ETX (real time). In addition to providing a viewer for this information, each page allows modification of its data when the selected environment allows such changes.

The view area of the Overview property page displays the current contents of each resource table in a device program. As shown in Figure 229, the Overview page displays an overview of the current loaded device program.

The selection of a property page is accomplished by moving the cursor over the desired tab and clicking the left mouse button. This action selects the desired property page and brings it to the top of the stack for viewing. The following sections describe the functionality of each Test Debugger property page.

Figure 229. Overview Property Page



Socket

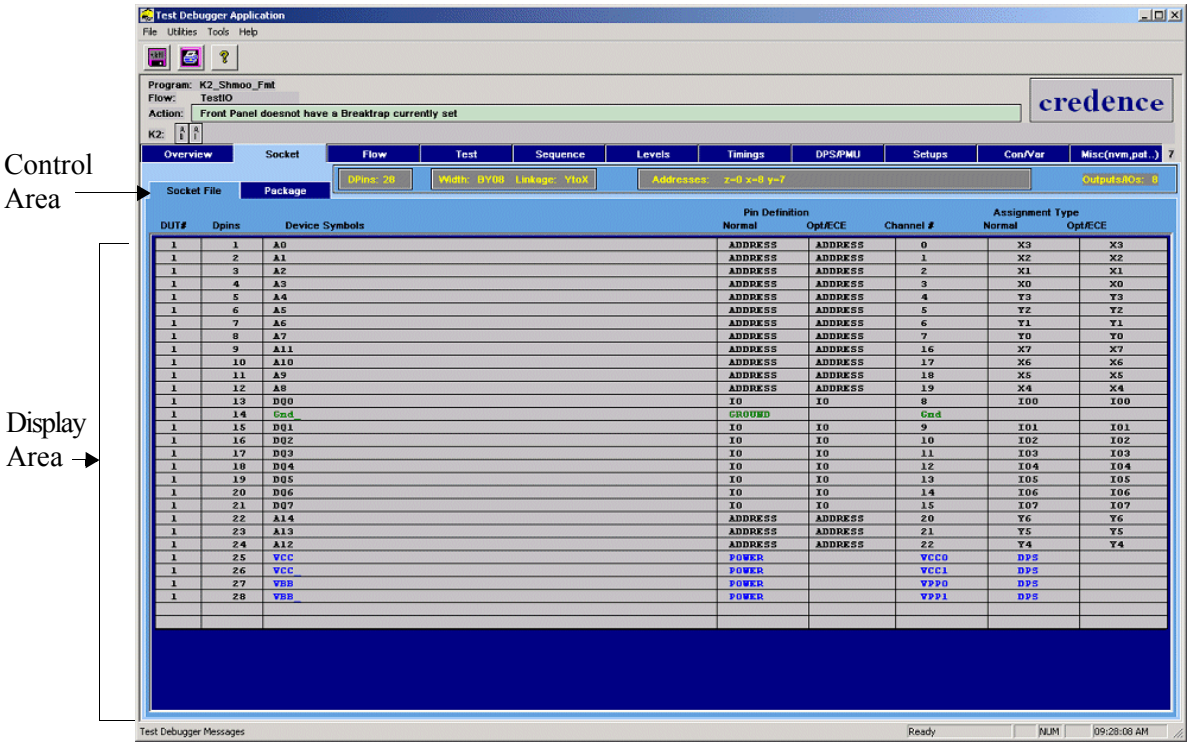
The Socket property page (see Figure 230) provides a view of the socket definition for the currently loaded test program file. The Socket property page, as with most property pages, is divided into two areas: control and display.

Two views are available on this property page: Socket File and Package. Under the control area, the user can select either the Socket File (text table) or the Package display (graphical display) of the Device Under Test (DUT). The display area is a read only interruption of the current socket file.

Socket File

Socket File is the default view (see Figure 230) of the socket information. This is a spreadsheet formatted text representation of the current socket file. From left to right, the columns provide information on: DUT number, Dpins, Device Symbols and type of Dpin function; Pin Definition, Channel numbers and Assignment Type (Normal - Opt/ ECE).

Figure 230. Socket Property Page - Table



Package

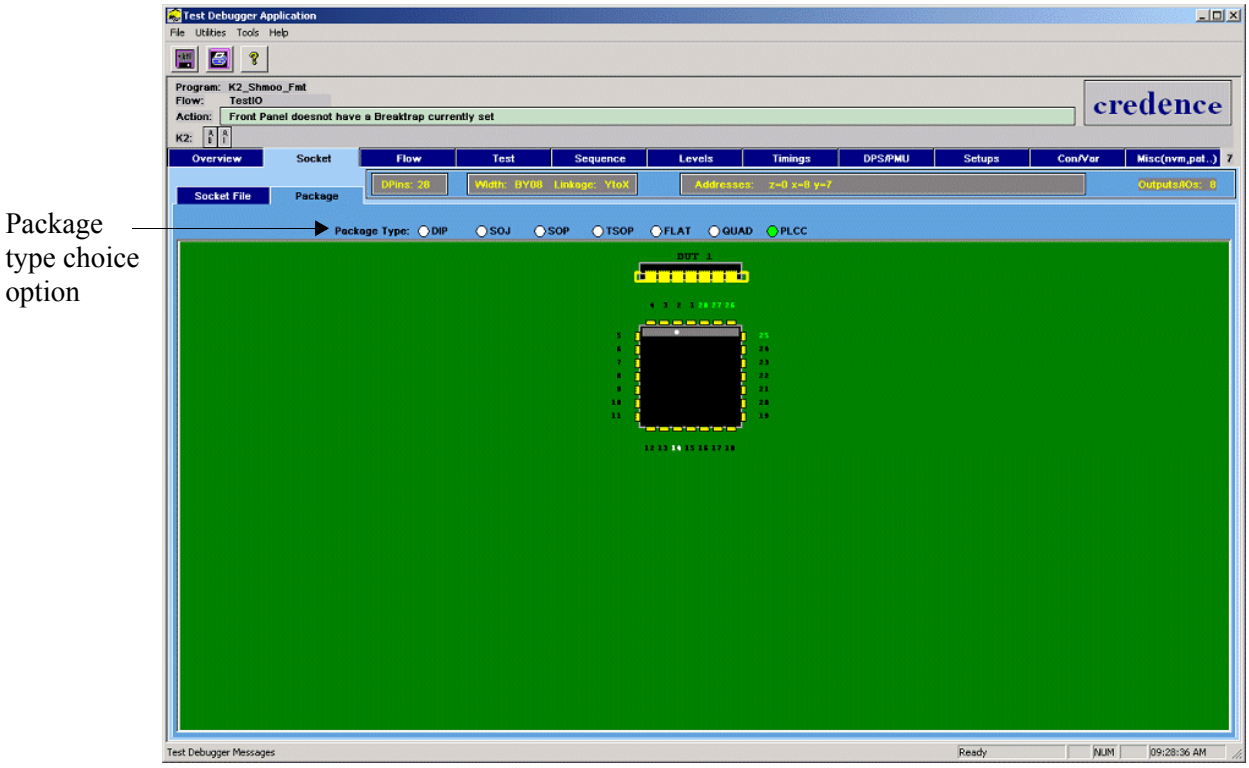
The Package page view (see Figure 231) displays a graphical representation of the DUT; showing the mapping of the device pins to tester channels. The package type may be chosen manually from the choices at the top of the property page. The following package types are available:

DIP	Dual inline package
SOJ	Small outline J-lead
SOP	Small outline package
TSOP	Thin small outline package
FLAT	Lead on both sides
QUAD	Quad small outline

PLCC Plastic leaded chip carrier

The default view is of a plastic leaded chip carrier (PLCC).

Figure 231. Socket Property Page - Package



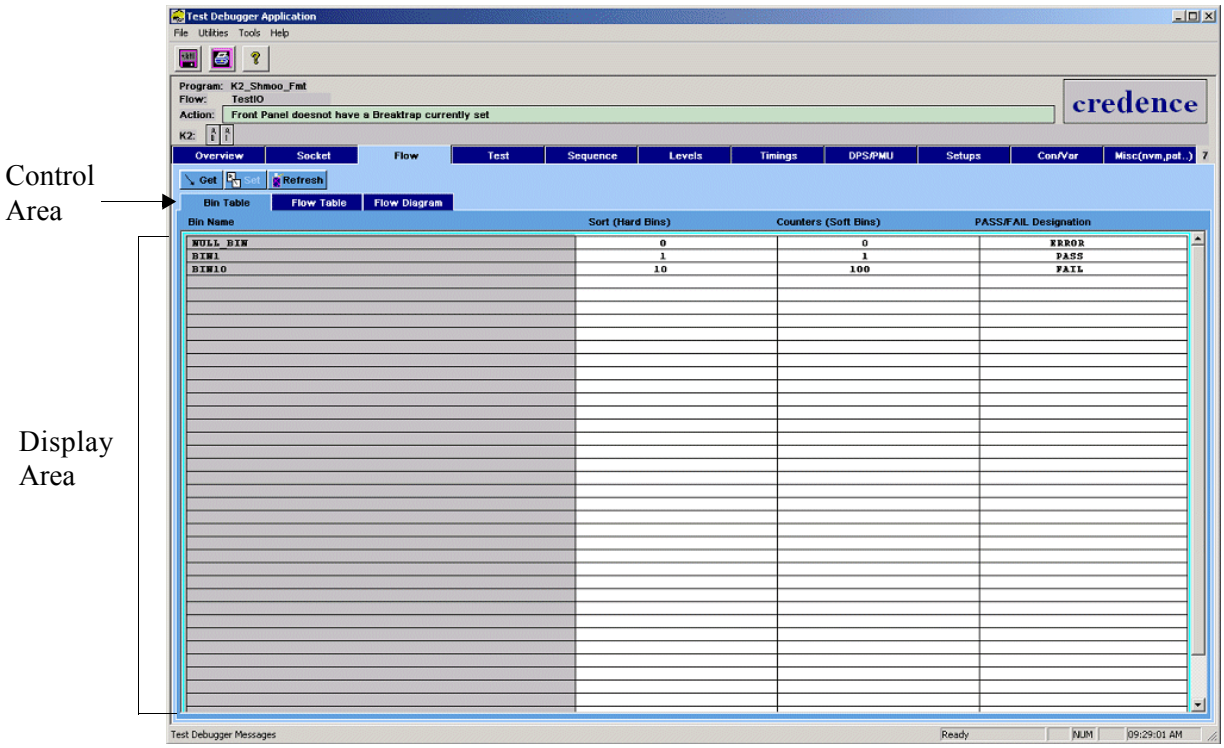
Flow

The Flow property page (see Figure 232) displays information regarding the connection of tests and bins for the selected flow of the current test program. Three views are available by way of the control area: Bin Table, Flow Table, and Flow Diagram. The different views are accessed by clicking on their corresponding sub-property page tabs.

Bin Table

The Bin Table (default view) lists the data of the current bin file, row by row. This information includes Bin Name, Sort (Hard Bins), Counter (Soft Bins), and PASS/FAIL Designation.

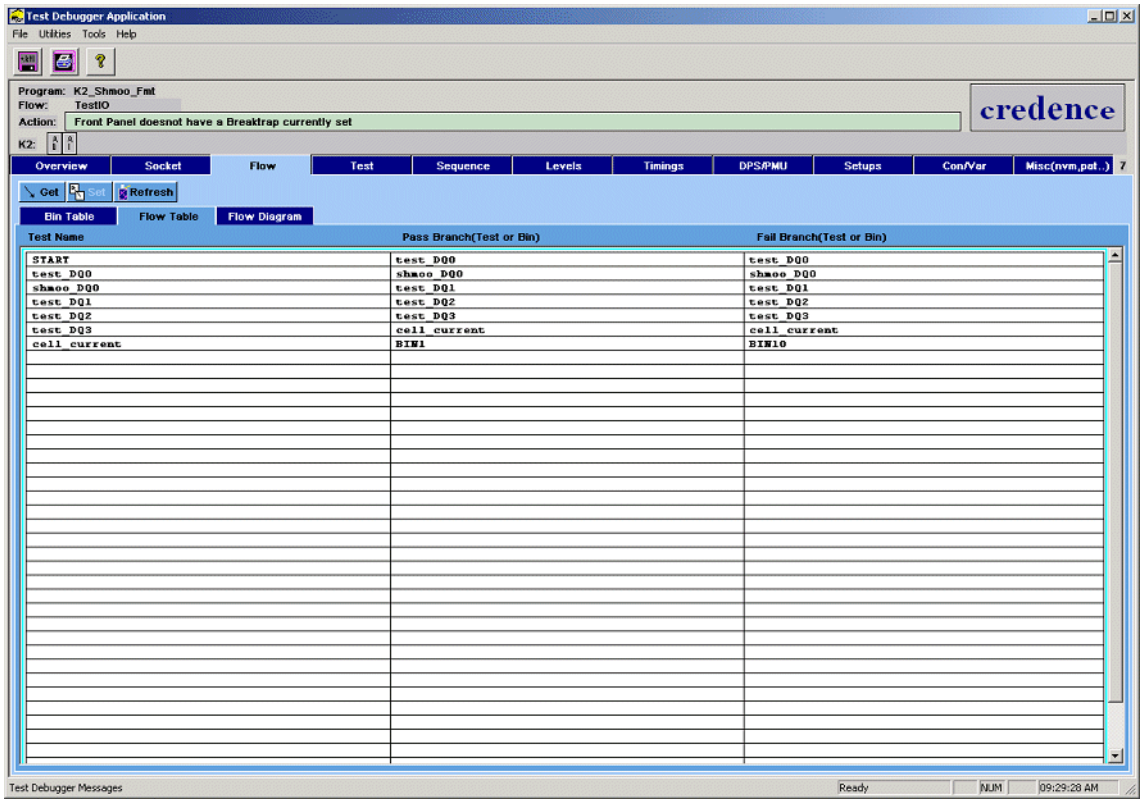
Figure 232. Flow Property Page - Bin Table



Flow Table

The Flow Table displays the flow of the current test program in spreadsheet format (see Figure 233). The information listed in each column represents a test sequence made up of the Test Name, with its respective Pass Branch (Test or Bin), and Fail Branch (Test or Bin) conditions. This view does not confirm that the flow is correct, but simply shows the currently selected flow of the loaded.

Figure 233. Flow Property Page - Flow Table

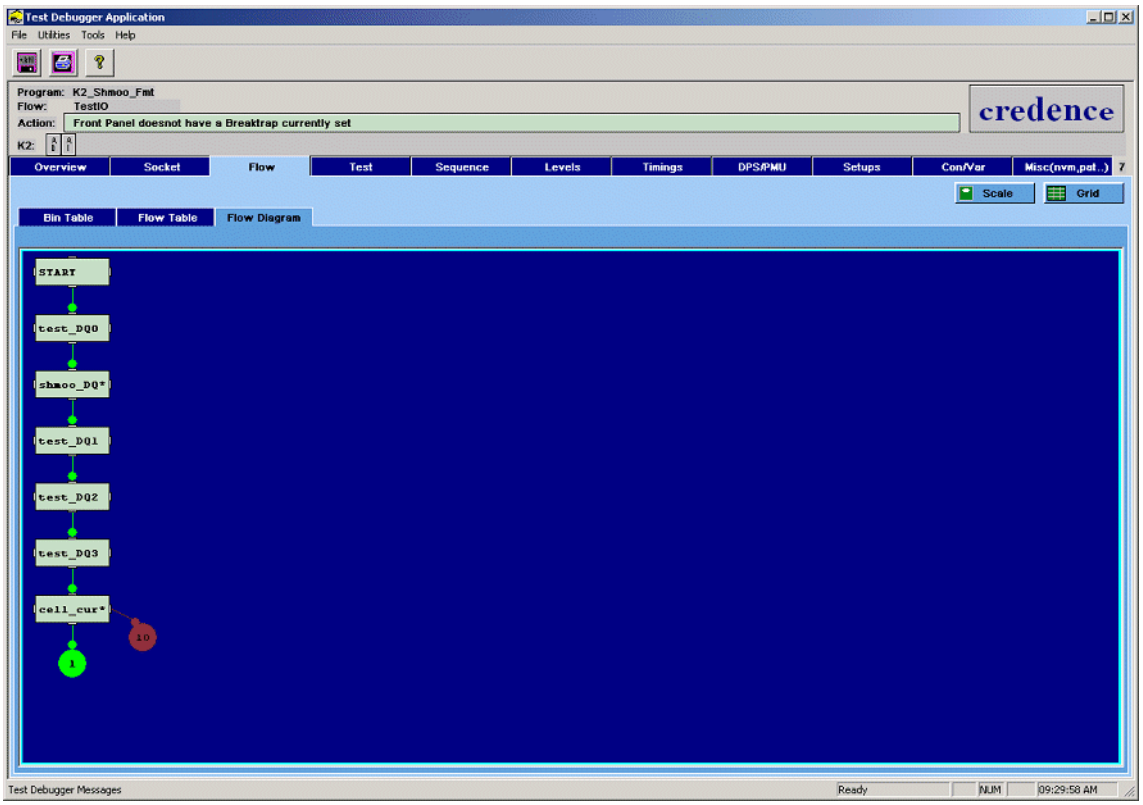


Flow Diagram

The Flow Diagram combines the Flow and Bin Table (see Figure 234). This is compiled, resulting in a graphical view. The graph displays the layout of the tests and bins for the current test program as a flow chart. Objects which represent tests and bins are connected by green and red lines which represent pass and fail conditions respectively. The test for which the breaktrap was set in Front Panel is highlighted in turquoise.

There are two control buttons under the graphical view: Scale and Grid. The Scale button allows the user to zoom in or out of the display. Grid toggles between showing and hiding grid lines on the flow chart.

Figure 234. Flow Property Page - Flow Diagram



Test

The Test property page (see Figure 235) displays details about the current test for which the breaktrap was set in Front Panel. There are two views available: Break Test and Select Test. As with most property pages, Test is divided into two areas: control and display.

The Test property page allows for viewing/displaying the contents of Break Test or any selected test of the currently loaded program by clicking on the Select Test/Break Test toggle button. In Figure 235, testppmu_fvmi_RZM is displayed.

The Set button (enabled only after executing an edit in Test Elements), re-loads the modified test to the selected ETX slice. Unless debug modes of looping are being executed, the user must restart the device program to initiate changes.

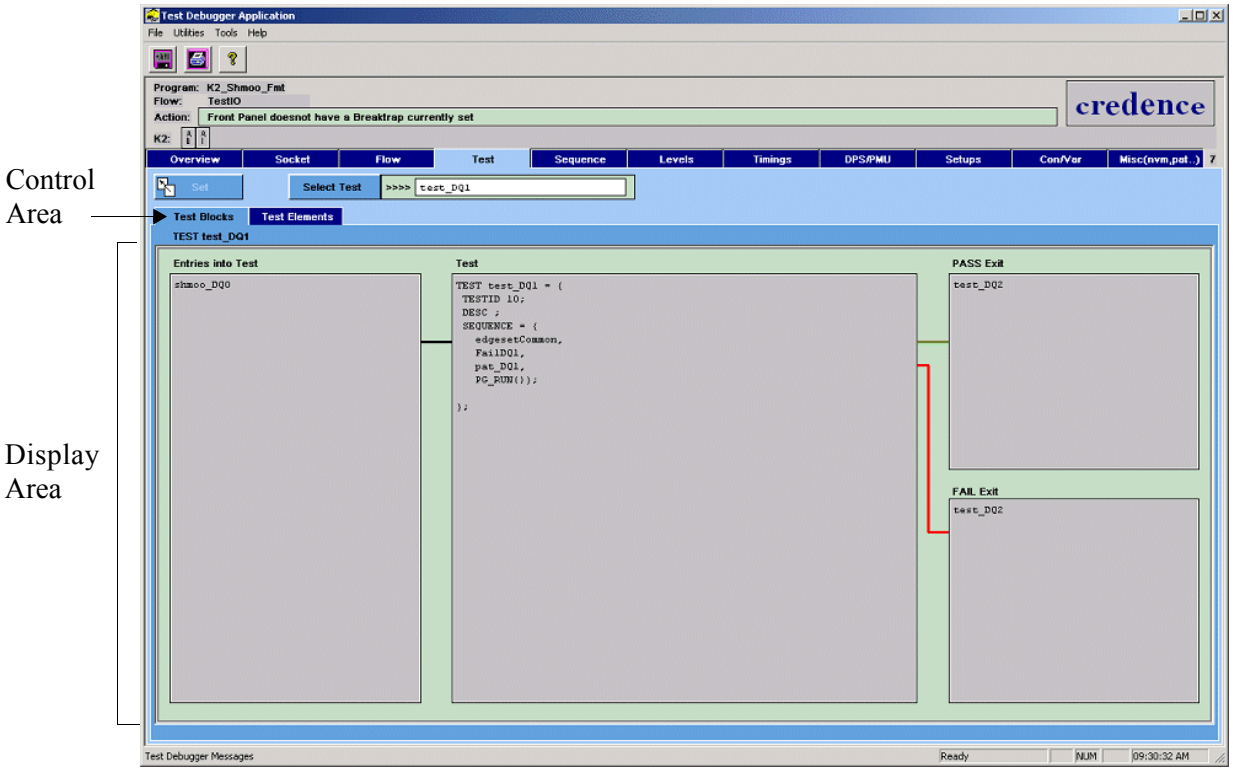
Test Blocks is a display (read only) area (see Figure 235).

Test Blocks

The Test Blocks property page is divided into four block areas. These blocks are provided for interpreting the displayed test, or a selected test of the current flow selection. They are Entries into Test, Test (composition), PASS Exit, and FAIL Exit.

The Test Blocks display a read-only view of the instructions contained in the test for which the breaktrap was set in Front Panel. The first block contains the name of the instruction or test which occurred directly before the breaktrap was set. The middle block shows the contents of the breaktrapped test. The last two blocks show the names of the next instructions or tests to be executed. The path taken depends on whether the current test passes (green line) or fails (red line).

Figure 235. Test Property Page - Test Blocks



Test Elements

The Test Elements property page (see Figure 236), also the test editor, is available by clicking the Test Elements button. This provides an alternate view of the current test status and component selections.

NOTE — A yellow highlighted “Set” button indicates the displayed test is different from the ETX test.

TEST testppmu_fvmi_R2M is the selected program test name.

The Edit Operations allow the user to edit selections in the “Selections” area to the test sequence by way of Edit Operations options.

The Selections section displays all current *.ktl function calls and selectable slice tables for inserting and/or appending into the Sequence of the current test.

The syntax of a test statement is shown in the example below. Any information enclosed in brackets [ ] is optional.

```
TEST name = {
   [TESTNO = number;]
   [DESC = "string";]
   [SEQUENCE = { item1, item2, ... itemN};]
};
```

The following actions are available for use in the test sequence. Refer to the Kalos Test Language chapter of the *KITE Reference manual* for a definition of each test sequence.

ADC(control)

CRAM_CLR(ALL | loc)

CRAM_LOG(“desc_text”, loc)

CRAM_LOG(“msg”, loc)

DELAY(time)

ECR_CLR()

ECR_CLR(PG1 | PG2 [, ALL])

ECR_CLR(PG1 | PG2, DUTwidth, Xsize, Ysize)

FORCE(PMU [, voltage])

IF(CRAM(loc) operator expr2, true_sequence, false_sequence)

IF(expr1 operator expr2, true_sequence, false_sequence)

IF((FLAG&elope2),XT,XF)

INC_FBIN(functional_bin)

LOOP(count, sequence)

MEAS(unit)

ON(fkey, sequence)

PAUSE()

PG_RUN([pattern] | pc [, ALL_PINS])

PG_RUN (PRECOND)

PG_STOP()

PMUCONN(pin | dps | OPEN)

PMU_RUN()

PMU_SET_BUMP_V(voltage)

SET(pin | dps, state)

SET(var_name, value)

SET(variable, expression)

SET_ALT(pin, alternate state)

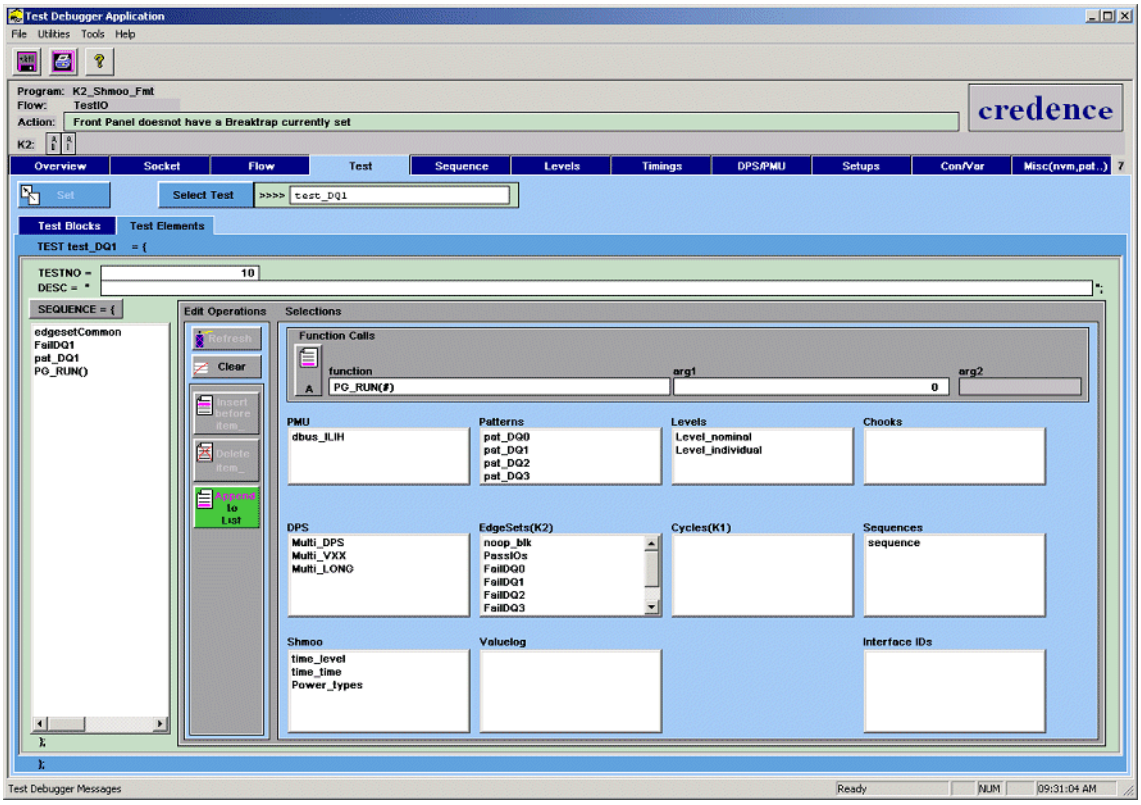
SET_BIN(target_bin, source_bin)

SET(flag)

SYNC_CYCLE(name)

SYNC_PC(pc)

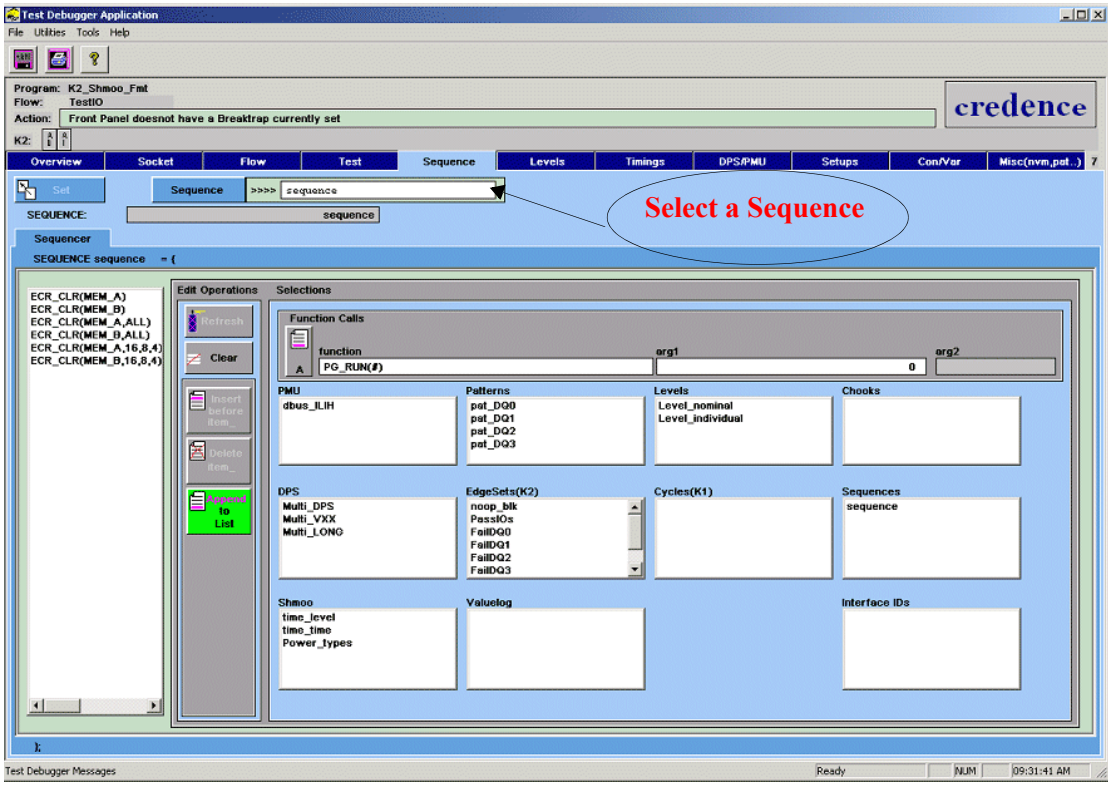
Figure 236. Test Property Page - Test Elements



Sequence

The Sequence property page displays the details of any sequence(s) in a test for which the breaktrap was set, or any selected sequence of the current program in Front Panel (see Figure 237). Sequencer is used as a container of events that can be represented by a name. There are two views available: Break Test and Sequence. Clicking on the Break Test/Sequence toggle button allows interaction between the Break Test or any selected Sequence of the currently loaded program. The functionality and editing options of the Sequence are the same as the Test property page.

Figure 237. Sequence Property Page



Levels

The Levels property page displays up to eight DC levels for each pin of a device under test. Available levels include VIH, VIL, VOH, VOL, IOH, IOL, VTH, and VIHH. This information may be displayed in either spreadsheet of graphical format.

Level Table

The Level Table property page provides a text representation of the levels data in a spreadsheet format. This property page allows for interaction between the Break Test or any Level Table of the current loaded program. The Pin/Group and Chn Checker are view only property pages, while the Level Table page allows the user to edit and modify the loaded levels for each pin/group.

The Apply/Set buttons allows the modified Level Table to re-load in the selected ETX slice. The difference is the Apply operation also sends the resource table to the Kalos 2 hardware. When selecting the Set operation (unless the debug modes of looping are being executed), the user must restart the device program to initiate changes.

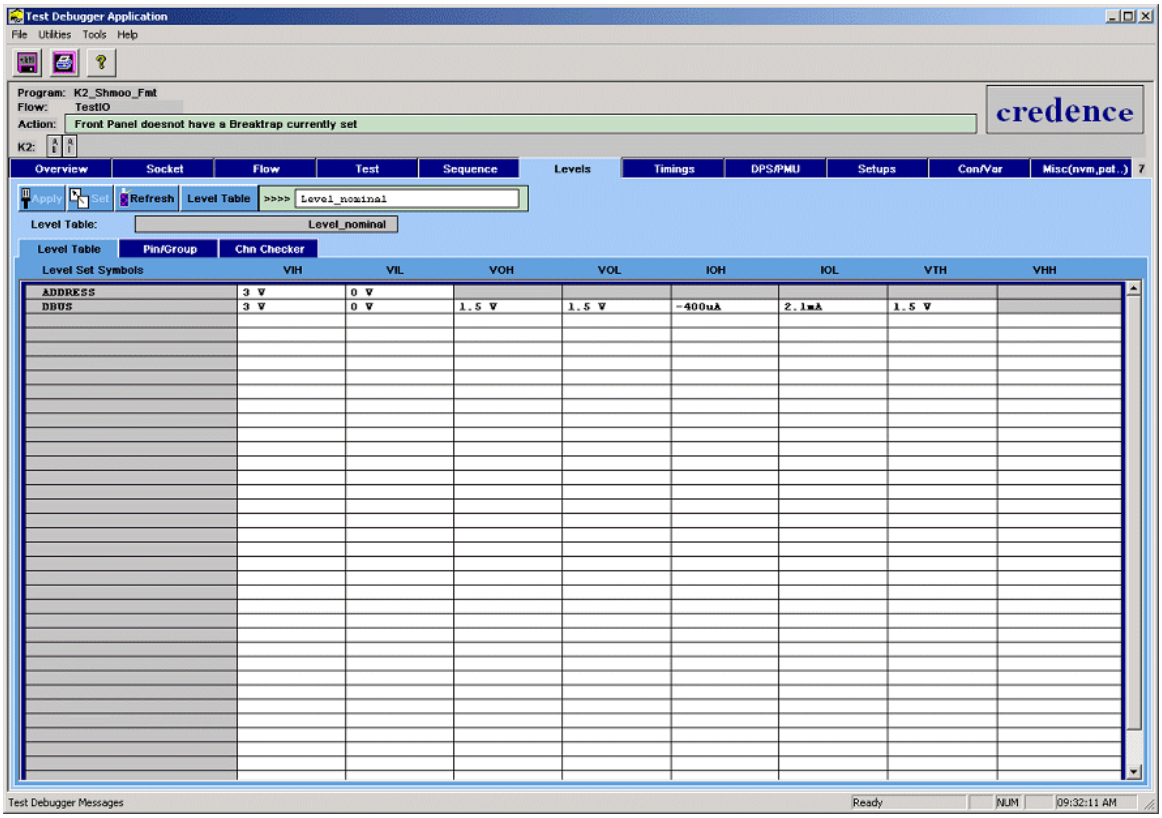
NOTE — The Apply/Set buttons are active only if their backgrounds are highlighted yellow.

The current Break Tests Level Tables or the selected Level Table controls allow for the selection of a specific Level Table of which can be viewed and/or edited.

The selection of three types of views are available: Level Table (shown in Figure 238), Pin/Group, or Chn Checker. The Chn Checker view is a read only view of the Break Test or any Level Table of the currently loaded program that is decoded to the basic socket file components (Dpins). In the Level Table view, the white background cells are available for editing. All entries are checked against the respective system limits.

NOTE — Undefined pins are shown in red text.

Figure 238. Levels Property Page - Level Table

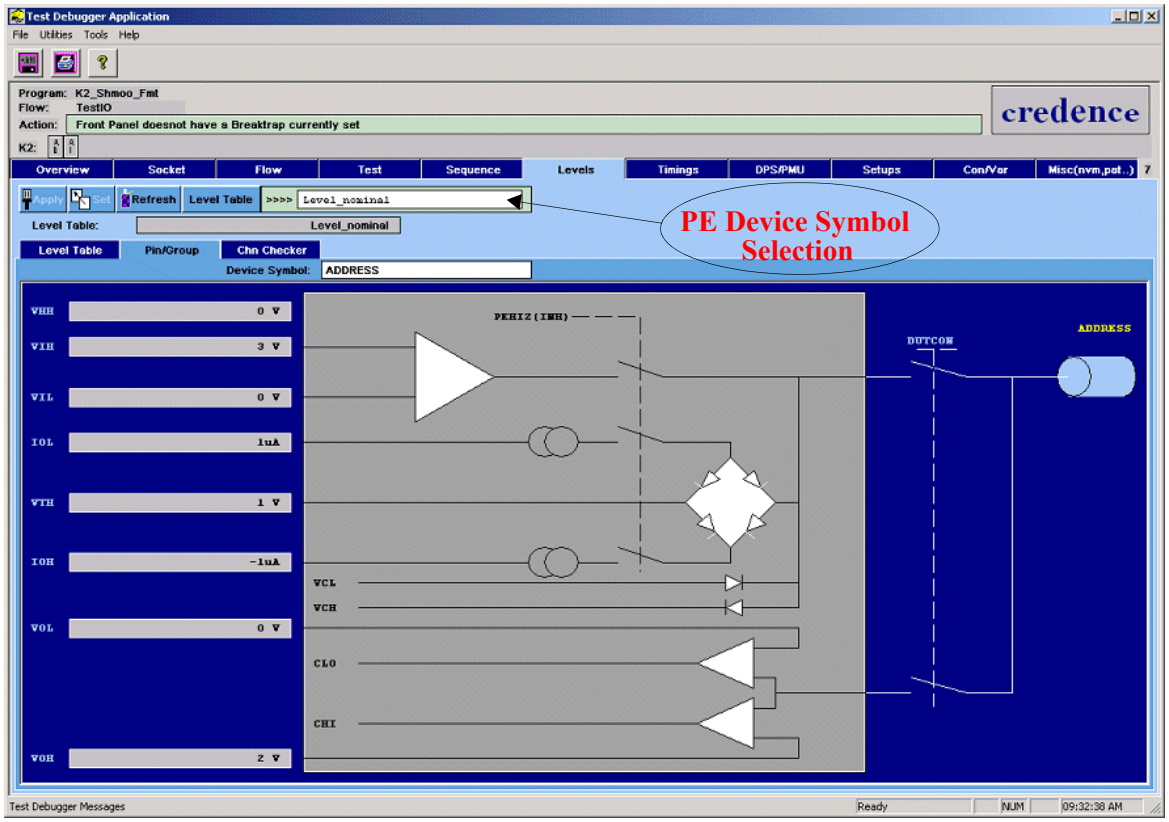

Test Debugger Application
File Utilities Tools Help
Program: K2_Shmoo_Fmt
Flow: TestIO
Action: Front Panel doesnot have a Breaktrap currently set
credence
K2:
Overview Socket Flow Test Sequence Levels Timings DPS/PMU Setups Con/Var Misc(nvm,pat..)
Apply Set Refresh Level Table >>>> Level_nominal
Level Table: Level_nominal
Level Table Pin/Group Chn Checker
Level Set Symbols VIH VIL VOH VOL IOH IOL VTH VHH
ADDRESS 3 V 0 V
DBUS 3 V 0 V 1.5 V 1.5 V -400uA 2.1mA 1.5 V
Test Debugger Messages
Ready
NUM
09:32:11 AM

Levels

The Pin/Group view option (see Figure 239) displays a graphical representation of the levels information for a single pin. Levels for each device pin can be viewed by choosing the symbol for the desired pin from the PE Device Symbol pulldown menu.

NOTE — The Test Debugger utility shows the levels in the applicable test as well as the levels in the sequence attached to the test. In other words it goes two levels deep when showing the levels settings for the tester hardware. If there is another sequence, nested within the original sequence, the levels feature is unable to display those levels.

Figure 239. Levels Property Page - Pin/Group



Timings

EdgeSet displays the timing, Format and Period, data in a spreadsheet format. The Chn Checker and Waveforms are view only pages. The white fields in the Timings, can be edited/modified.

The Apply/Set buttons allow the modified cycle table to re-load in the selected ETX slice. The difference is the Apply operation also sends the resource table to the Kalos 2 hardware. When selecting the Set operation (unless the debug modes of looping are being executed), the user must restart the device program to initiate changes.

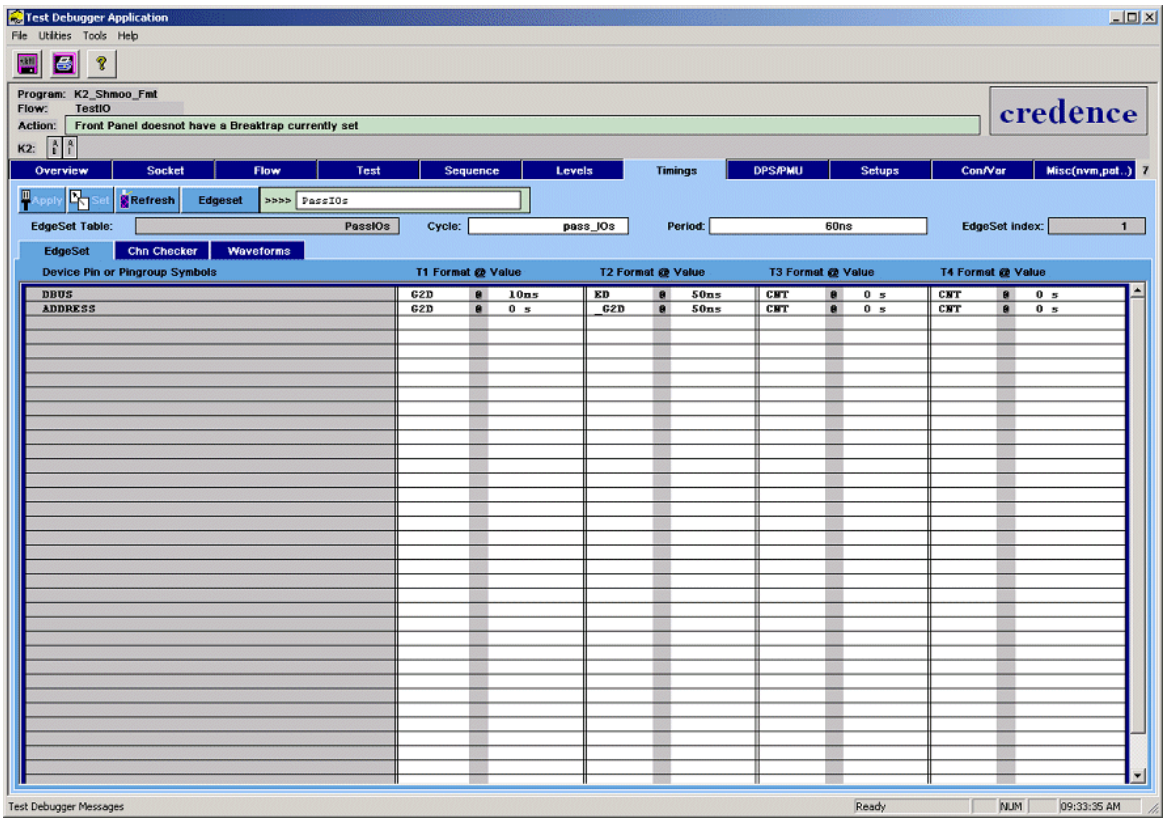
NOTE — The Apply/Set buttons are active only if their backgrounds are highlighted yellow.

The current Break Tests cycle table or the selected cycle table controls allow for the selection of a specific cycle table for viewing and/or editing. The user can tab through and select which one of the three views to display: EdgeSet, Chn Checker, or Waveforms.

Figure 240 shows the EdgeSet property page with the white background cells available for editing. All entries are checked against the respective system limits.

NOTE — If a Kalos 1 program is loaded or if Kalos 1 timing tables are included, then Timings, Format, and Period property pages are provided. In this case, a button appears (in the Cycles field) that allows you to switch back and forth.

Figure 240. Timings Property Page - Timings EdgeSet


Test Debugger Application
File Utilities Tools Help
Program: K2_Shmoo_Fmt
Flow: TestIO
Action: Front Panel doesnot have a Breaktrap currently set
credence
K2:
Overview Socket Flow Test Sequence Levels Timings DPS/PMU Setups ConVar Misc(nvm,pat..)
Apply Set Refresh Edgeset >>>> PassIOs
EdgeSet Table: PassIOs Cycle: pass_IOs Period: 60ns EdgeSet index: 1
EdgeSet Chn Checker Waveforms
Device Pin or Pingroup Symbols
T1 Format @ Value
T2 Format @ Value
T3 Format @ Value
T4 Format @ Value
DBUS G2D @ 10ns ED @ 50ns CNT @ 0 s CNT @ 0 s
ADDRESS G2D @ 0 s _G2D @ 50ns CNT @ 0 s CNT @ 0 s
Test Debugger Messages
Ready
NUM
09:33:35 AM

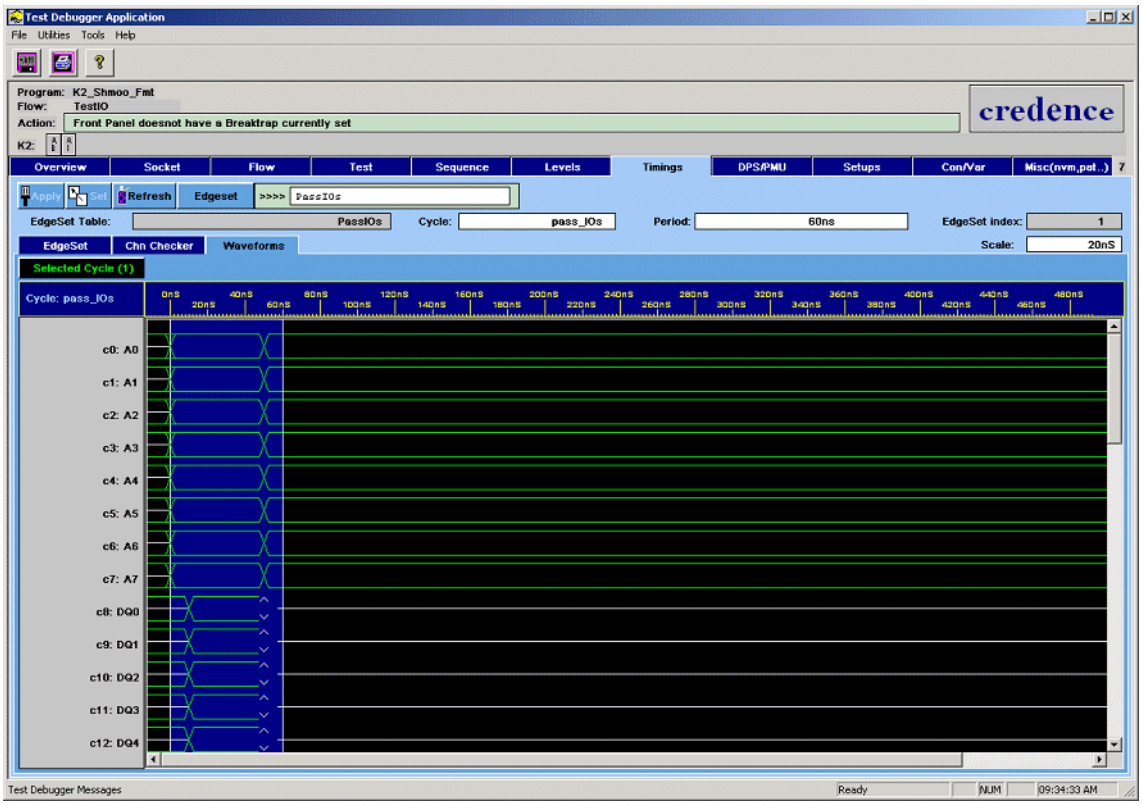
Chn Checker

The Chn Checker property page allows for a Device Pin checker for their respective resources. This is a view only property page.

Waveforms

The Waveforms view in Figure 241 shows a read-only display of the timing waveforms for each pin.

Figure 241. Timings Property Page - Waveforms



DPS/PMU

The DPS (power supplies) Setups (tab) editor on the DPS/PMU property page (see Figure 242) allows for interaction between the Break Test or any selected DPSSET of the current loaded program.

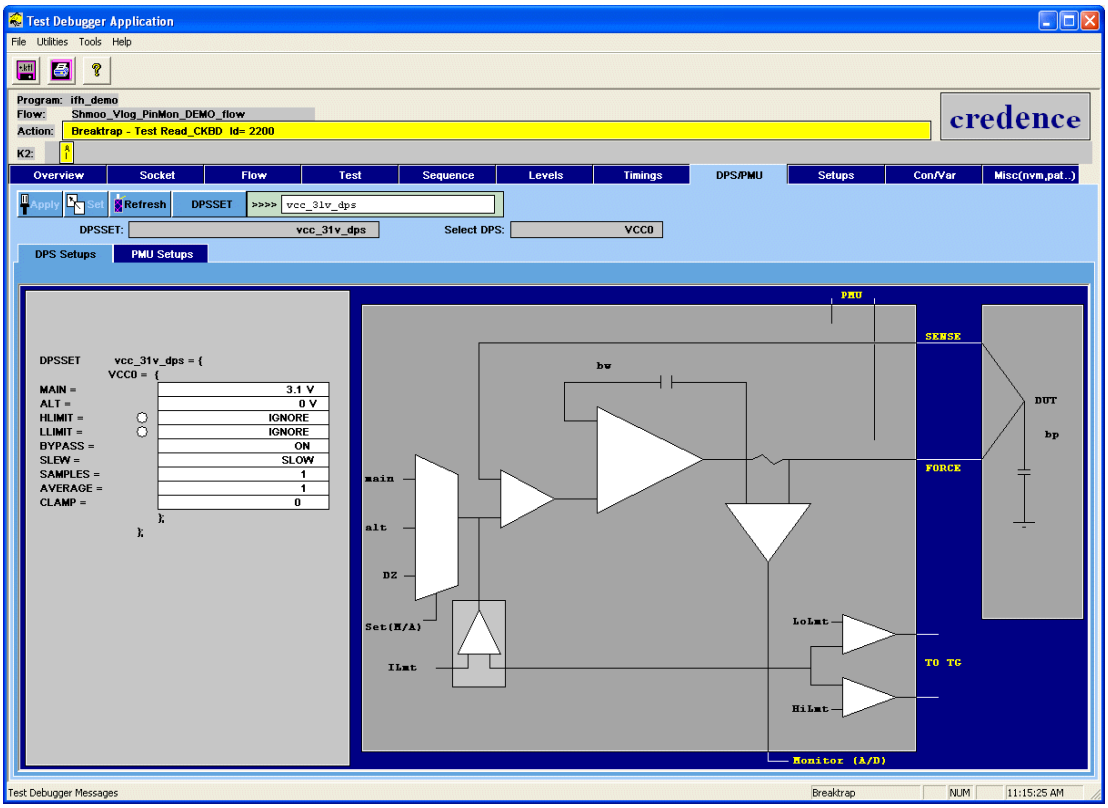
The Apply/Set buttons reload the modified DPSSET in the selected ETX slice. The difference is the Apply operation also sends the resource table to the Kalos 2 hardware (if it is displayed in yellow). When selecting the Set operation (unless the debug modes of looping are being executed), the user must restart the device program to initiate changes.

NOTE — The Apply/Set buttons are active only if their backgrounds are highlighted yellow.

By selecting Break Test, if the Break Test sequencer has a DPSSET or DPSSETs, the user can select one for display and modification.

NOTE — If the Break Test sequencer has no DPSSET present, the selection must be the DPSSET Tables.

Figure 242. DPS/PMU Property Page DPS Setups Tab



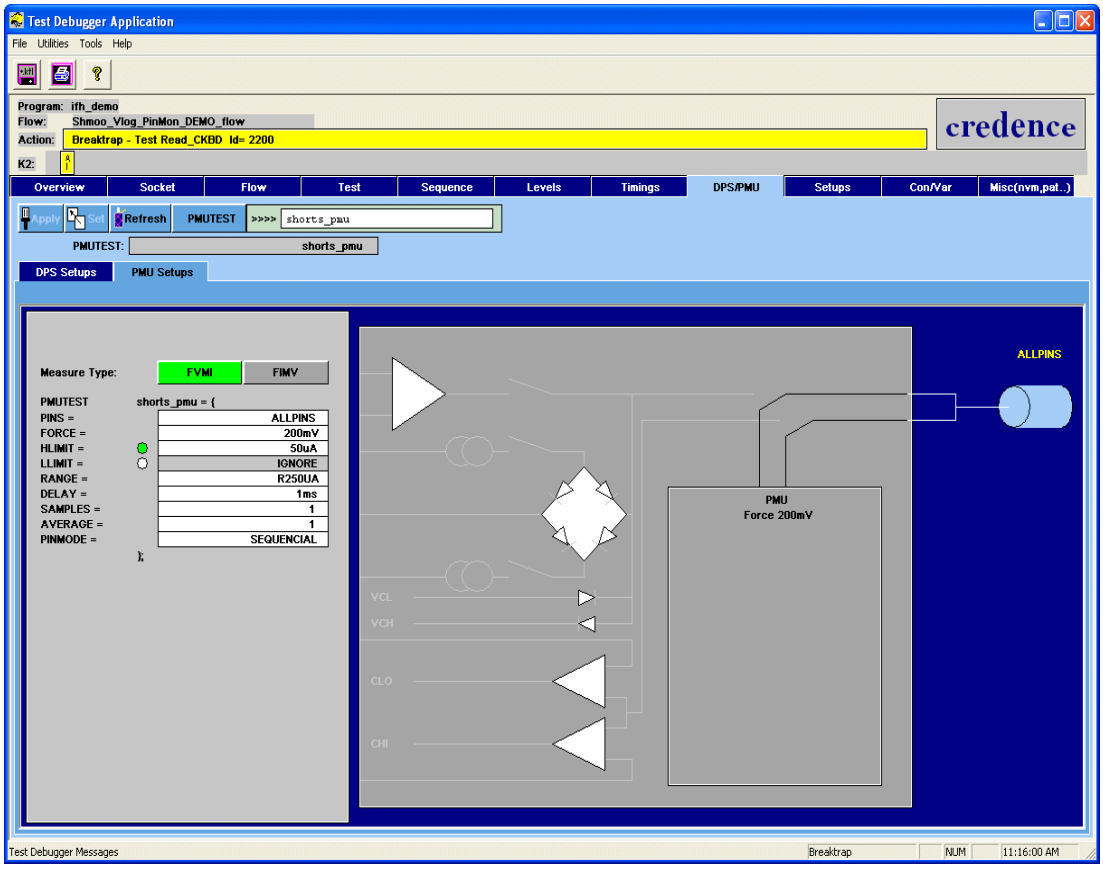
The PMU Setups (tab) editor on the DPS/PMU property page (see Figure 243) allows for interaction between the Break Test or any selected PMU test of the currently loaded program.

The Apply/Set buttons allows the modified PMU test to re-load in the selected ETX slice. The difference is the Apply operation also sends the resource table to the Kalos 2 hardware. When selecting the Set operation (unless the debug modes of looping are being executed), the user must restart the device program to initiate changes.

NOTE — The Apply/Set buttons are active only if their backgrounds are highlighted yellow.

The PMU test of the current test can be displayed and its setup viewed and/or edited. The selected PMU conditions are displayed by entering the test string or by way of the pulldown selection. All or any conditions can be changed.

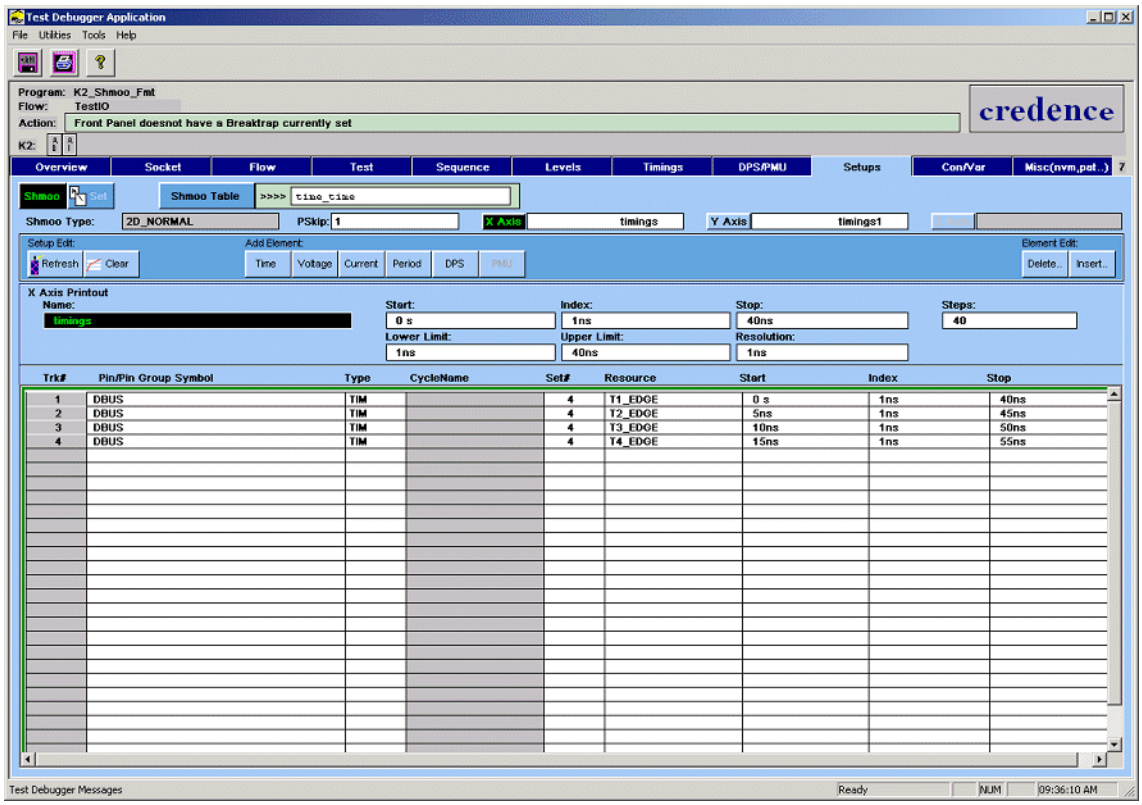
Figure 243. DPS/PMU Property Page PMU Setups Tab



Setups

Setups are Shmoo and Valuelog setup tables and expression sequence editors (see Figure 244). This allows for modification of setup values by editing the respective text field (white area only). A toggle button in the upper left corner of the page allows the user to select Shmoo or VLog. If shmoo is selected, the user can select a shmoo table from the *Shmoo Table* drop-down menu. If VLog is selected, the user can select a value log table from the *VLog Table* drop-down menu.

Figure 244. Setups Property Page


Test Debugger Application
File Utilities Tools Help
Program: K2_Shmoo_Fmt
Flow: TestIO
Action: Front Panel doesnot have a Breaktrap currently set
credence
K2:
Overview Socket Flow Test Sequence Levels Timings DPS/PMU Setups Con/Var Misc(nvm,pat..)
Shmoo Set Shmoo Table >>>> time_time
Shmoo Type: 2D_NORMAL PSkip: 1 X Axis timings Y Axis timings1
Setup Edit: Refresh Clear
Add Element: Time Voltage Current Period DPS PMU
Element Edit: Delete.. Insert..
X Axis Printout
Name: timings
Start: 0 s
Index: 1ns
Stop: 40ns
Steps: 40
Lower Limit: 1ns
Upper Limit: 40ns
Resolution: 1ns
Trk# Pin/Pin Group Symbol Type CycleName Set# Resource Start Index Stop
1 DBUS TIM 4 T1_EDGE 0 s 1ns 40ns
2 DBUS TIM 4 T2_EDGE 5ns 1ns 45ns
3 DBUS TIM 4 T3_EDGE 10ns 1ns 50ns
4 DBUS TIM 4 T4_EDGE 15ns 1ns 55ns
Test Debugger Messages
Ready
NUM
09:36:10 AM

Cons/Vars

Constants and Variables (Cons/Vars) allows for modification of variable values or expressions by editing the respective text field (white areas only). See Figure 245. Also displayed are the constants and their respective values, however, modifications are not allowed.

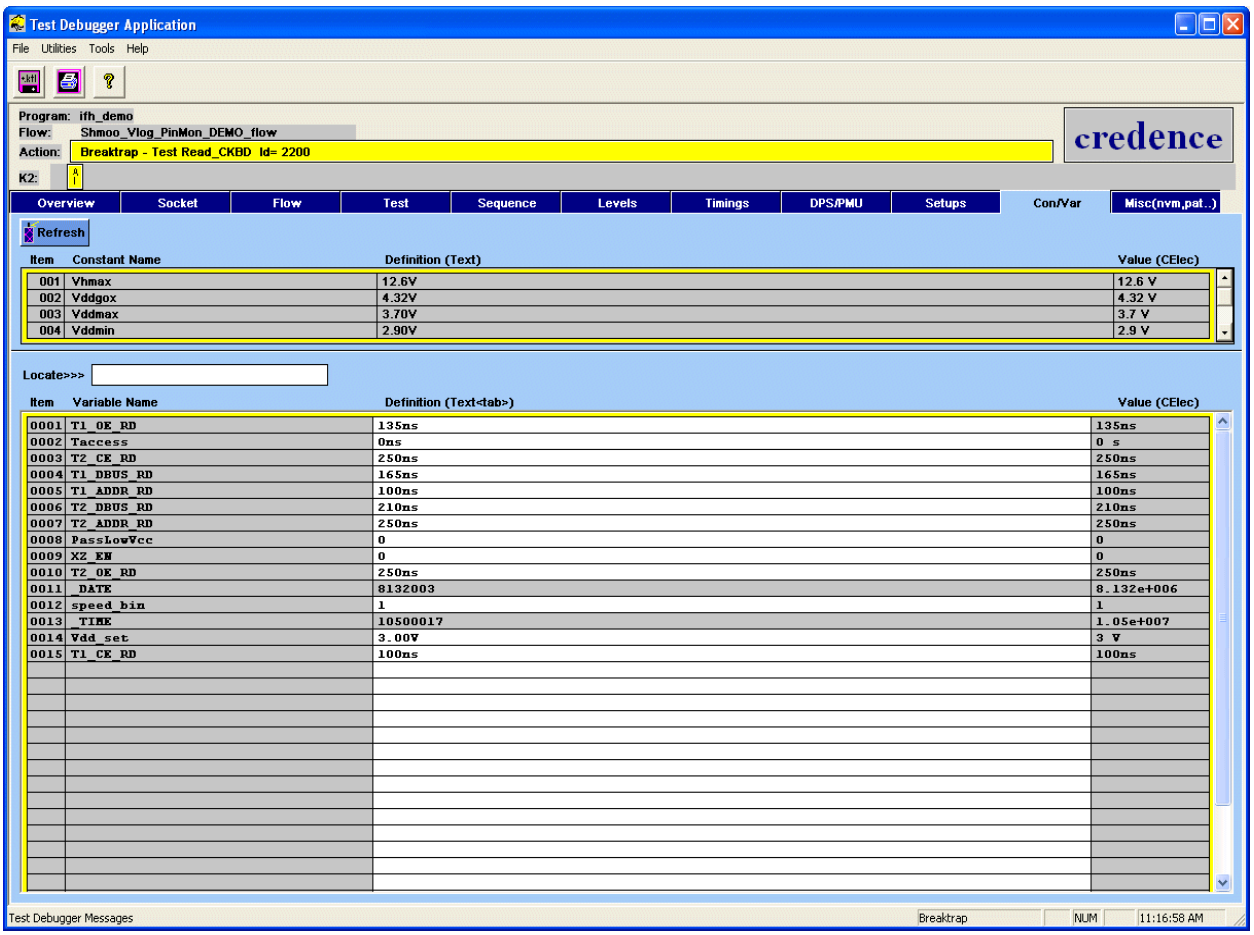
A program is easier to read and change if certain numbers are assigned a name. A CONSTANT statement assigns a unique name to a defined value. Once defined, a CONSTANT is substituted anywhere within the test program where a value or var-expr is used.

A VARIABLE is a storage place for numbers. When it is created it is assigned a unique name and a value using the VARIABLE statement. Once created and assigned a value it may be substituted anywhere within the test program where a number would normally be used. The DPSSET, PMUTEST, TSET_TABLE, PSET_TABLE, TIMING, and LEVELS all accept variable expressions (var-expr) when assigning values to their associated resources.

Variables provide a powerful tool for runtime modification of resource values. They can also be used to make decisions within a C-Hook using TPEGetVar() and TPESetVar(). Variables that do not reference other variables are referred to as scalar. Only scalar variables can be modified using TPESetVar() or the SET option in a SEQUENCE statement. Refer to the Kalos Test Language chapter of the *KITE Reference Manual* for additional information, definitions, and examples of variables.

NOTE — The maximum amount of variables and constants available to users is 2048 on a Kalos 2 tester. On a Kalos 1 tester, the maximum amount available is 1024.

Figure 245. Cons/Vars Property Page



Misc(nvm,pat...)

The Misc(nvm,pat...) property page displays NVM loadboard data, and pattern statement fail modes of which can be changed by way of the Patterns tab.

NVM ID's

The NVM ID's property page (see Figure 246) displays selected fields from the optional Non-Volatile Memory (NVM) on the Device Interface Board (DIB) of the Kalos 2 test system.

The INTERFACE_ID table is not currently supported in KTL. The following fields are read from the loadboard on the system, and displayed in the LOAD_BOARD field:

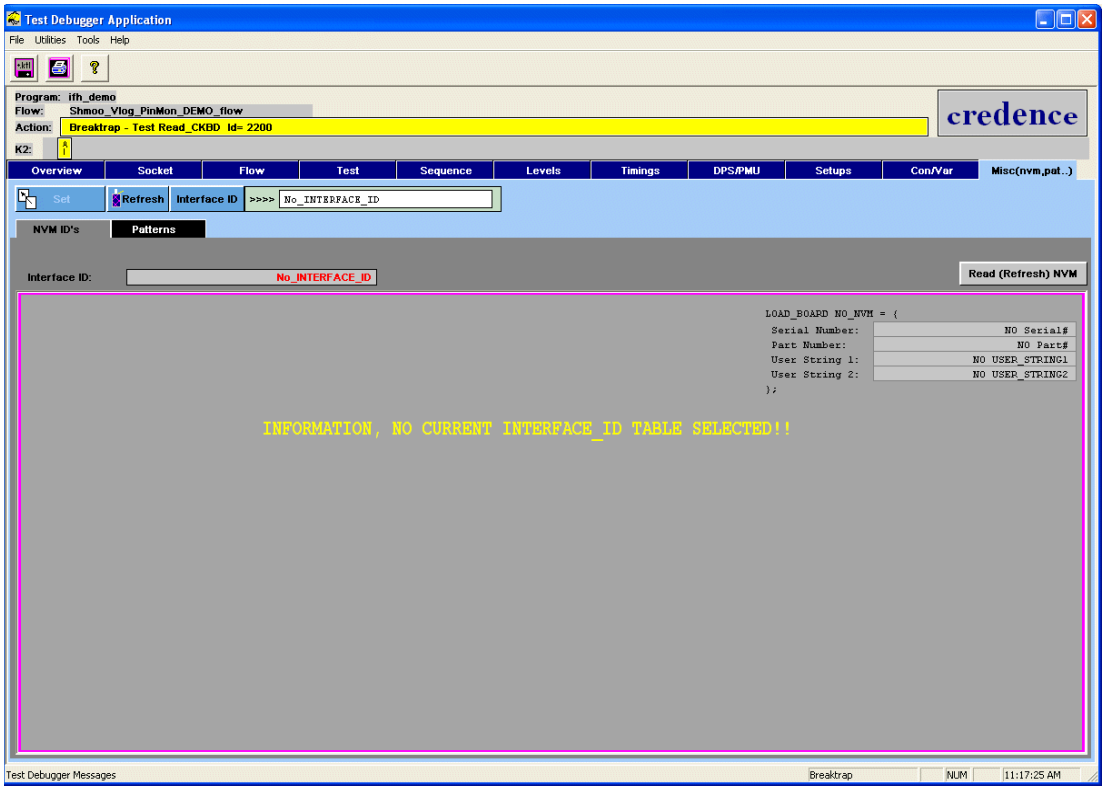
Serial Number - up to 16 character string
Part Number - up to 16 character string
User String 1 - up to 16 character string
User String 2 - up to 16 character string

Use the *Read (Refresh) NVM* button to read the loadboard data, and display it in the LOAD_BOARD fields of the NVMDIB ID property page.

If an NVM device with the PIB board part number, serial number, and path exists, the contents can be read by selecting *DBI Info* from Front Panel, then select *Utilities* => *NVMDIB* to launch the dib- [NVM View] window.

Program help is provided in the *Device Interface Board NVM User's Guide*. This guide is accessed from the *dib- [NVM View]* window. From this window, select *Help* => *User Guide*.

Figure 246. Misc NVM ID's Property Page

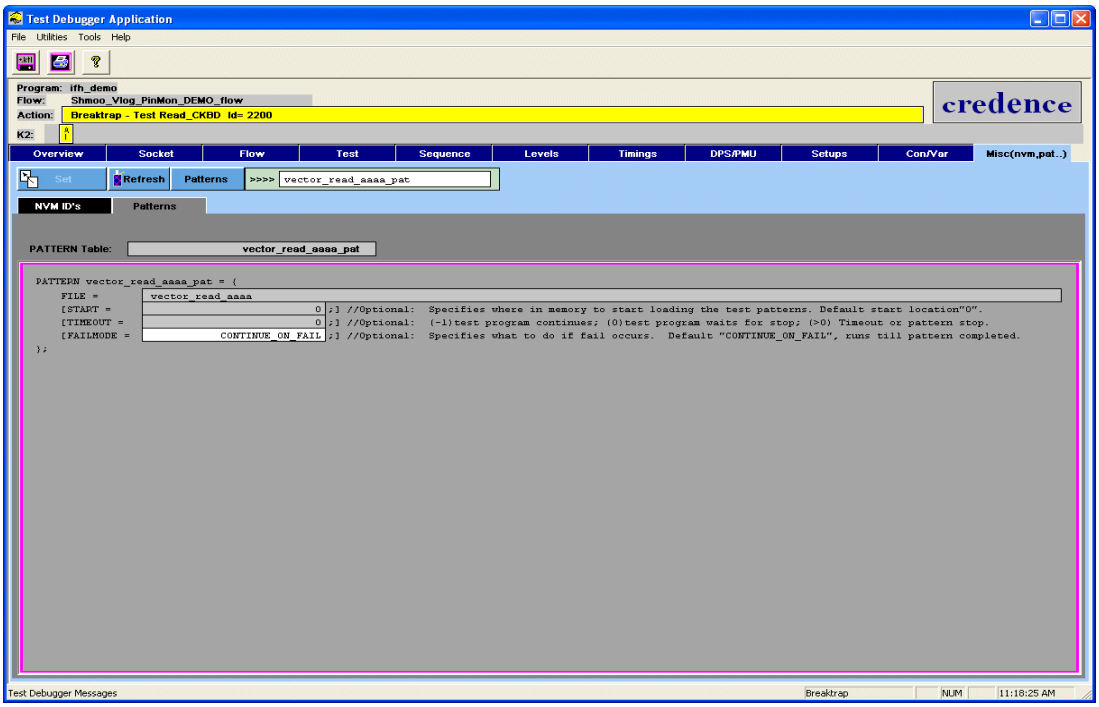


Patterns Tab

The Patterns property page, shown in Figure 247, allows the user to view the patterns statements that are listed within the loaded test program and modify the FAIL_MODE argument in the patterns statement. The fail modes are:

- **Abort_on_fail** - Encounters a failure and stops the pattern burst. Then goes to the fail flow call.
- **Continue_On_Fail** - Completes the pattern burst and then goes to the fail flow call.

Figure 247. Misc Patterns Property Page


Test Debugger Application
File Utilities Tools Help
Program: ifh_demo
Flow: Shmoo_Vlog_PinMon_DEMO_flow
Action: Breaktrap - Test Read_CKBD Id= 2200
K2:
credence
Overview Socket Flow Test Sequence Levels Timings DPS/PMU Setups Con/Var Misc(nvm,pat..)
Set Refresh Patterns >>>> vector_read_aaaa_pat
NVM ID's Patterns
PATTERN Table: vector_read_aaaa_pat
PATTERN vector_read_aaaa_pat = (
FILE = vector_read_aaaa
[START = 0 ;] //Optional: Specifies where in memory to start loading the test patterns. Default start location"0".
[TIMEOUT = 0 ;] //Optional: (-1)test program continues; (0)test program waits for stop; (>0) Timeout or pattern stop.
[FAILMODE = CONTINUE_ON_FAIL ;] //Optional: Specifies what to do if fail occurs. Default "CONTINUE_ON_FAIL", runs till pattern completed.
);
Test Debugger Messages
Breaktrap
NUM
11:18:25 AM

7

SHMOO AND BITMAP TOOLS

This chapter provides operational descriptions of Shmoo and Bitmap tools. An introduction to the BitPower tool is also provided.

The Shmoo tool includes multiple applications, Pin Monitor, and Value Log. The shmoo is used to characterize various parameters of the device under test by creating a graphic display of the relationship between defined parameters over a range of values. Setup parameters are easily entered at any time for any test program. A total of 4096 tracking parameters per axis are available, and any parameter of the tester can be shmooed against any other.

The Pin Monitor is an application that allows the user to evaluate the performance of a DUT on a per pin basis. The evaluation is performed by creating one dimensional shmoo plots of each system resource that is allocated to a pin, with pass/fail criteria supplied by the breaktrap test.

The Value Log application provides an AC Datalogger that is available on Kalos 2 test systems. Two types of test execution are available to users: a binary (search) or a linear (sweep) test.

The Bitmap tool has multiple operational modes available on Kalos 2 tester systems. These operations include online (data gathered using Kalos 2 Memory Tester) and offline (*.bfm files, saved during online/offline operations) interactions.

The Bitmap viewer displays current (online) cell/address failures of the device under test. This includes two screen displays: Bitmap and MegaMap. The MegaMap is a compressed view of the total DUT’s bit array, whereas the Bitmap is a selected encompassed block of the MegaMap. Maximum size of the MegaMap is 256 x 256 compression. Maximum size of the Bitmap, selected block, is 1024 x 1024 (or 1 megabit display).

Introduction

The Shmoo Application tool is used to characterize various parameters of the DUT by creating a graphic display of the relationship between two parameters over a range of values. Setup parameters are easily entered at any time for any test program.

The Shmoo Application tool is a viewer that shows pass/fail regions of a selected device, and/or system variables plotted within a two-dimensional coordinate system. Basic features of this tool include the following:

- One (1-D) and Two-dimensional (2-D) plot for normal, pass skip, linear, binary, linear log, and binary log shmoo plots.
- Three-dimensional (3-D) plot for fail to pass or pass to fail surface displayed results in the third dimension.
- DPS and DC parametric XY plot; the XY plot of forced versus measured values.
- Accumulate operational mode for all plots except three-dimensional.
- ASCII file operations including import setups, export setups, and print support.
- Support for online and offline setup (import/export) operations.

The Shmoo tool includes multiple applications. The Shmoo tool is the top level operation that incudes Pin Monitor and Valuelog property pages.

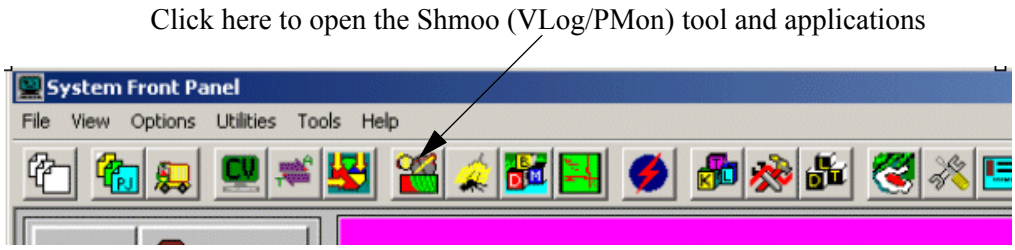
The Pin Monitor is an application which allows the user to evaluate the performance of a DUT on a per pin basis. The evaluation is performed by creating one dimensional shmoo plots of each system resource that is allocated to a pin. This provides detailed information for the device margins with respect to the system resource, and is also helpful in debugging applications.

The Value Log application provides an AC Datalogger that is available on Kalos 2 test systems. Two types of test execution are available to users: a binary (search) or a linear (sweep) test. The result is determined by the selected Setup, and is the pass point at the detected fail/pass region.

Shmoo Tool

The Shmoo tool is accessible only in Engineering mode. That is, user login is required. The Shmoo tool can be launched by clicking on the *Shmoo, PMon VLog* icon located on the toolbar of Front Panel (see Figure 248) or by selecting *Tools* => *Shmoo, PMon VLog* from the menu bar.

Figure 248. Shmoo, PMon, VLog Tools

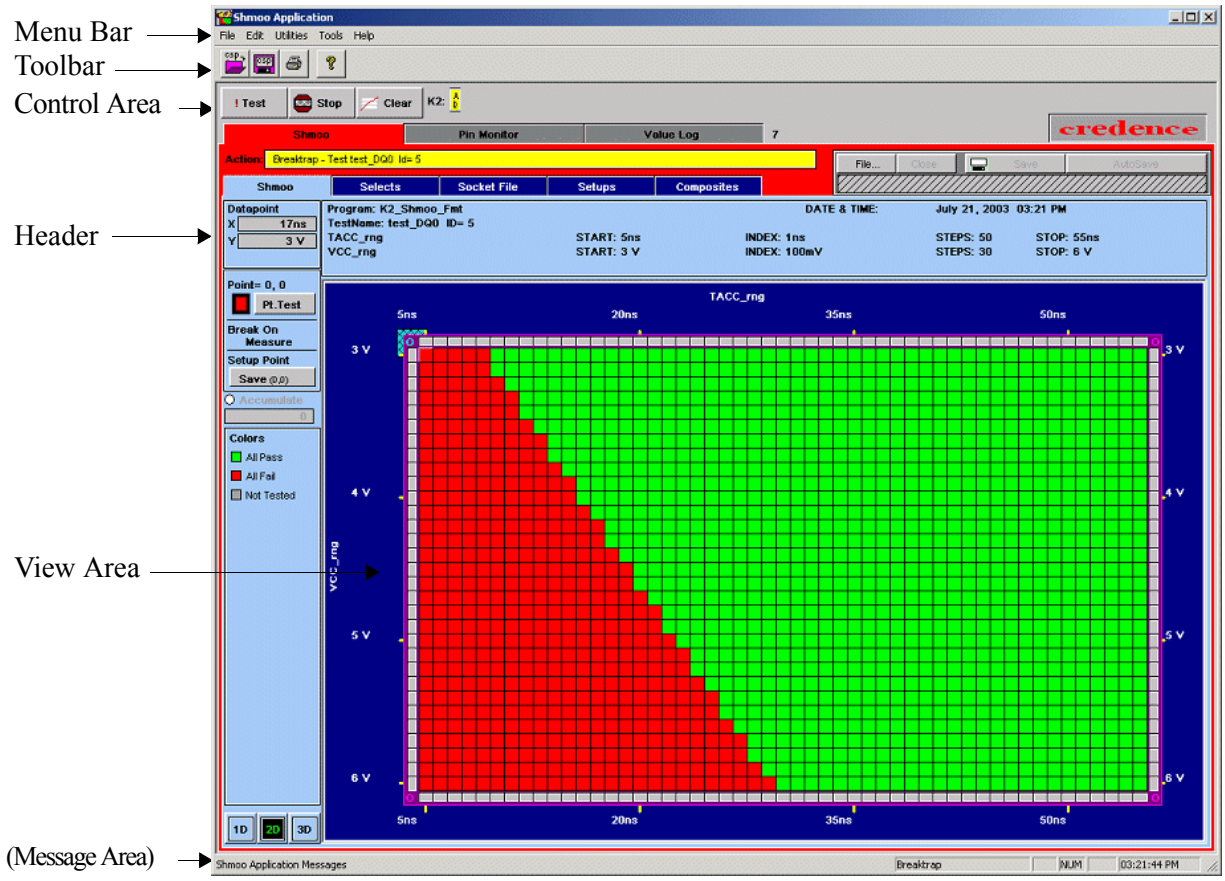


Graphical User Interface

The Shmoo Application tool is executed by selecting *Tools* => *Shmoo* from the Front Panel menu bar or clicking the *Shmoo, PMon VLog* button on the Front Panel toolbar. The main Shmoo Application window, shown in Figure 249 in its minimized state, is subdivided into the following defined operational areas.

- Menu Bar
- Toolbar
- Control Area
- Header
- View Area

Figure 249. Shmoo Primary Window



Menu Bar

The menu bar contains pulldown menu controls that include File, Edit, View, Selects, Utilities, Tools, and Help.

The following describes each item on the menu bar:

- File - Pulldown menu includes:

Export Setups	Saves all current setups.
Import Setups	Erases the current setups, then reads the setups of the selected file into the application.
Print	Schedules a print hard copy or write file operation for the current shmoo plot screen. Output is an ASCII data printout or file.

Print Preview	Displays a screen view of how the file will look once it is printed, allowing the user to review the data before invoking the Print operation.
Print Setup	Allows setup, formatting and path control of the print operation.
Shmoo (*.shm) Open File	Opens *.shm (shmoo file extension) file for saving shmoo plots.
Save to File	Option to manually save the current completed shmoo plot to the Open *.shm file.
Auto Save to Open File	Sets automatic save at the completion of each shmoo plot.
Composite (*.acc) Open File	Opens *.acc (composite shmoo file extension) file for saving a Composite Shmoo plot. User controlled save is the only option available.
Save to File	Option to manually save the current Composite Shmoo plot to the Open *.acc file.
Exit	Closes the Shmoo tool and any associated windows.

- Edit - Pulldown menu

  The Edit pulldown menu contains a list of setup edit commands. These are available only when the Setup property page is selected. These commands are discussed in detail in the Setups Property Page section of this chapter.

- Utilities - pulldown menu:
  Launches the selected utility application.
- Tools - Pulldown menu;
  Launches the selected tool application.
- Help - Pulldown menu (About Shmoo):
  Displays the current revision information for the Shmoo tool.

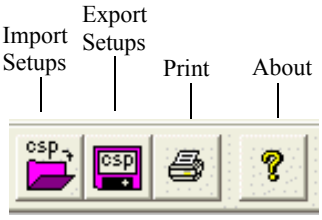
Toolbar

The toolbar is an arrangement of graphical icon buttons, clustered in functional groups that when chosen, execute commands. These buttons contain the most commonly used commands of the File and Selects pulldown menu options located on the menu bar.

When displayed, the toolbar is located directly below the menu bar of the main application window.

Figure 250 shows the layout of the toolbar, and lists the command executed for each toolbar button.

Figure 250. Shmoo Toolbar



Control Area

The Control Area in Figure 249 contains buttons to start testing, stop testing, and clear the current shmoo data.

Header

The Header area in Figure 249 consists of a working shmoo plot header showing the current status of the X, Y and Z axes.

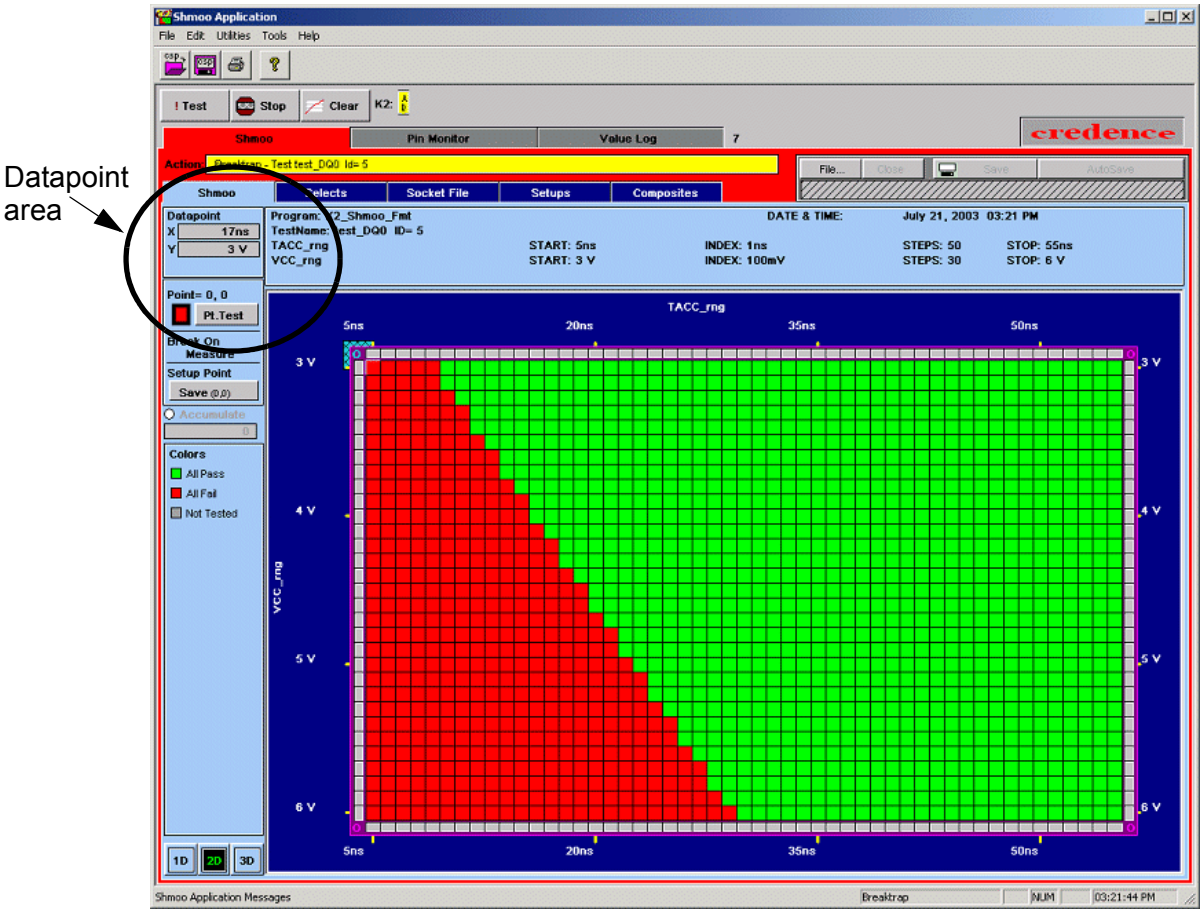
View Area

The view area provides a display of the selected property page. Moving the cursor over the desired tab and clicking the left mouse button accomplishes the selection of a property page.

Shmoo Display (Property Page)

The Shmoo display interface property page of the Shmoo Application, shown in Figure 251, illustrates a normal 2-D shmoo - VCC versus access timing.

Figure 251. Shmoo Display



Datapoint

The X and Y coordinates of a particular datapoint on the shmoo plot are shown in the Datapoint area (see Figure 251) of the Shmoo display view when the cursor is placed over that point in the plot. As the cursor moves, the current XY coordinates of the datapoint are displayed.

X and Y coordinates are shown whether the shmoo plot has data or not. The read back values are up to date to the current selected X and Y axis variables.

The Datapoint coordinates are displayed in the Point= section when clicking (left mouse button) on a datapoint in the view area. The Pt. Test re-executes the measurement for the selected datapoint.

NOTE — Single point testing is only available in normal 2-D shmoo.

Colors

The Colors section of the interface identify datapoints that passed, failed, or were not tested by color:

All Pass - green
All Fail - red
Not Tested - gray

Graphic Area

The graphic area displays the current shmoo.

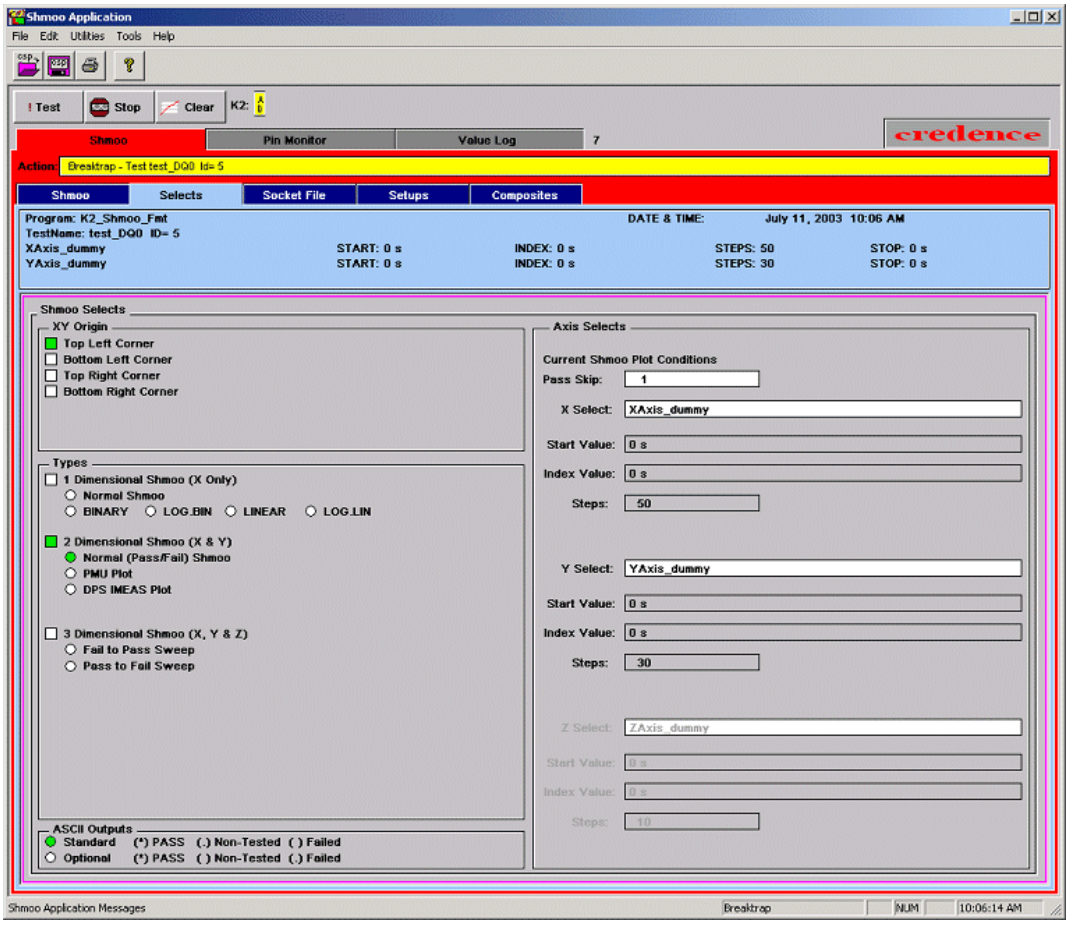
Setting Up the Shmoo Plot

The user has exceptional control over shmoo plot parameters. Setting properties and conditions is accomplished by way of the shmoo graphical user interface. The property pages are used to the setup these conditions.

Selects Property Page

The shmoo plot Selects property page contains setup controls for XY origin, shmoo plot type, and defined variable setups for the X, Y, and Z axes. The variable setups are defined under the Setups property page. The Selects interface, shown in Figure 252, is divided into functional areas based on these basic controls.

Figure 252. Selects Property Page



XY Origin

The XY Origin condition allows the user to set the starting datapoint origin (step zero of the selected variables) of the current shmoo plot. When a new XY origin is chosen, the shmoo is redrawn using the new origin. There are four possible settings. The following describes each setting.

Top Left Corner

Places the origin at the upper-left corner of the shmoo display so that execution of the plot is from top to bottom and left to right. This is the default condition of the shmoo environment.

Bottom Left Corner

Resets the origin to the lower-left corner of shmoo display so that execution of the plot is from bottom to top and left to right.

Top Right Corner

Resets the origin to the upper-right corner of the shmoo display so that execution of the plot is from top to bottom and right to left.

Bottom Right Corner

Resets the origin to the lower-right corner of shmoo display so that execution of the plot is from bottom to top and right to left.

NOTE — The shmoo origin can be chosen, from the top level shmoo, by mouse clicking the desired corner.

Types

The Types condition allows the user to choose the type of shmoo plot to be executed: One Dimensional (1-D), Two Dimensional (2-D), or Three Dimensional (3-D).

1-D Shmoo

1-D Shmoo setting causes the shmoo plot to be generated in one dimension along the X-axis so that only the X Select variable setup is active. There are no additional Type setups for a 1-D Shmoo.

Normal Shmoo	Tests every datapoint from the first to the last point.
BINARY	Binary search - looks for a pass, then a fail, then selects the next test point in between those two points. (Binary search is faster than linear search.)

Example 1. Starts pass/fail search in the center of X minimum/
maximum parameters. If pass:
move the strobe to maximum X.
If pass: move strobe to minimum X...If pass, move to...If pass move to... Continue until all test points are verified.

Example 2. Starts pass/fail search in the center of X minimum/
maximum parameters. If pass:
move strobe to maximum X.
If pass: move strobe to minimum X...If fail, move to...If fail, move to... Continue until all test points are verified.

LOG.BIN — Performs the same search routine as the BINARY search, except that it only displays the last pass point and value at the last pass/fail boundary.

LINEAR — Linear search - looks for a pass/fail at each location. This is the most complete shmoo search. (Linear search is the slowest shmoo search.)

Example Starts pass/fail search at the minimum X value. It strobes for pass/fail and places the result in shmoo display, then moves to the next [index]. This process is repeated until all locations are verified.

LOG.LIN — Performs the same search routine as the LINEAR search, except that it only displays the last pass point and value at the last pass/fail boundary.

2-D Shmoo

2-D Shmoo setting causes the shmoo plot to be generated in two dimensions along the X and Y axes. Both the X Select and Y Select variable setups are active.

Normal (Pass/Fail) Shmoo
Causes the fail datapoints of the generated shmoo plot to be represented by a red colored datapoint. No interpretation of the fail data is performed.

PMU Plot
: XY plot of PMU Forced variable (YAxis only) versus the measured value (XAxis). Also checks that breaktraps test has initial conditions (Engineering units and FVMI/FIMV) equal to the forced variable. Note: Only one PMU variable per setup is allowed. If multi-pins are to be measured then there must be a pre-defined pingroup for that selection.

DPS IMEAS Plot
: XY plot of DPS forced variable (YAxis only) versus the measured value (XAxis).

3-D Shmoo

This setting causes the shmoo plot to be generated in three dimensions along the X, Y versus Z axes. When this option is chosen, the sweep condition (sweep for fail or pass) for the Z axis variable setup is selected.

Fail to Pass Sweep
: Enables execution of the Z axis sweep condition until a pass datapoint is detected.

Pass to Fail Sweep
: Enables execution of the Z axis sweep condition until a fail datapoint is detected.

Axis Selects

Axis Selects provides information on the current shmoo plot conditions and allows for the selection of pass skip or pre-defined variable setups.

Pass Skip Number

Controls the skip datapoints between pass points along the X axis. This results in faster execution in the pass region, as a specified number of datapoints are skipped. A boundary shmoo plot is generated when the pass skip number is greater than or equal to the number of X axis steps.

X Select

This field allows the user to choose from a list of pre-defined axis variable setups. Left mouse click in the white area to view the list.

Y Select

This field allows the user to choose from a list of pre-defined axis variable setups. Left mouse click in the white area to view the list.

Z Select

This field allows the user to choose from the list of pre-defined variable setups. Left mouse click in the white area to view the list. The Z Select option is activated when 3-D Shmoo is selected.

Start Value

The axis start value (x, y, or z) displayed on the shmoo plot.

Index Value

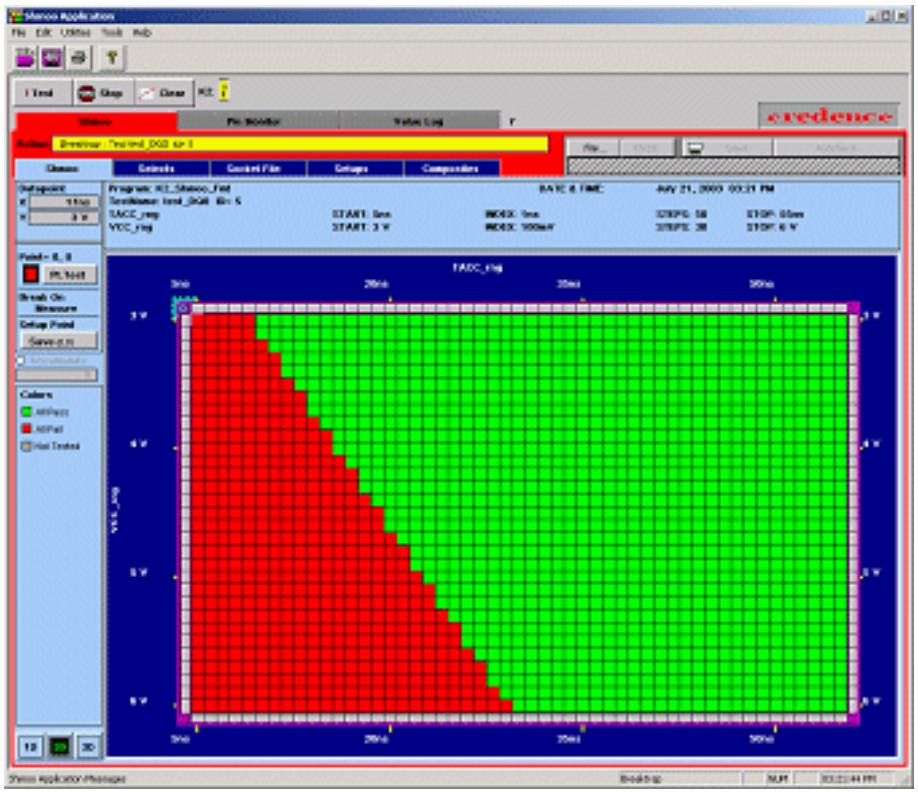
The axis index value (x, y, or z). Size of step increments as shown in the shmoo plot. (The index value is independent for print and tracking values.)

Steps

Total number of steps/increments on the axis.

The example in Figure 253 illustrates a 2-D Shmoo plot with the pass skip set to five.

Figure 253. Pass Skip Example



ASCII Outputs

Standard and optional shmoo plot ASCII base hardcopy printout options are available to users. The following is an ASCII representation of the three types of datapoints:

Standard	(␣) Fail tested	(*) Pass	(.) Not
Optional	(.) Fail tested	(*) Pass	(␣) Not

Socket File Property Page

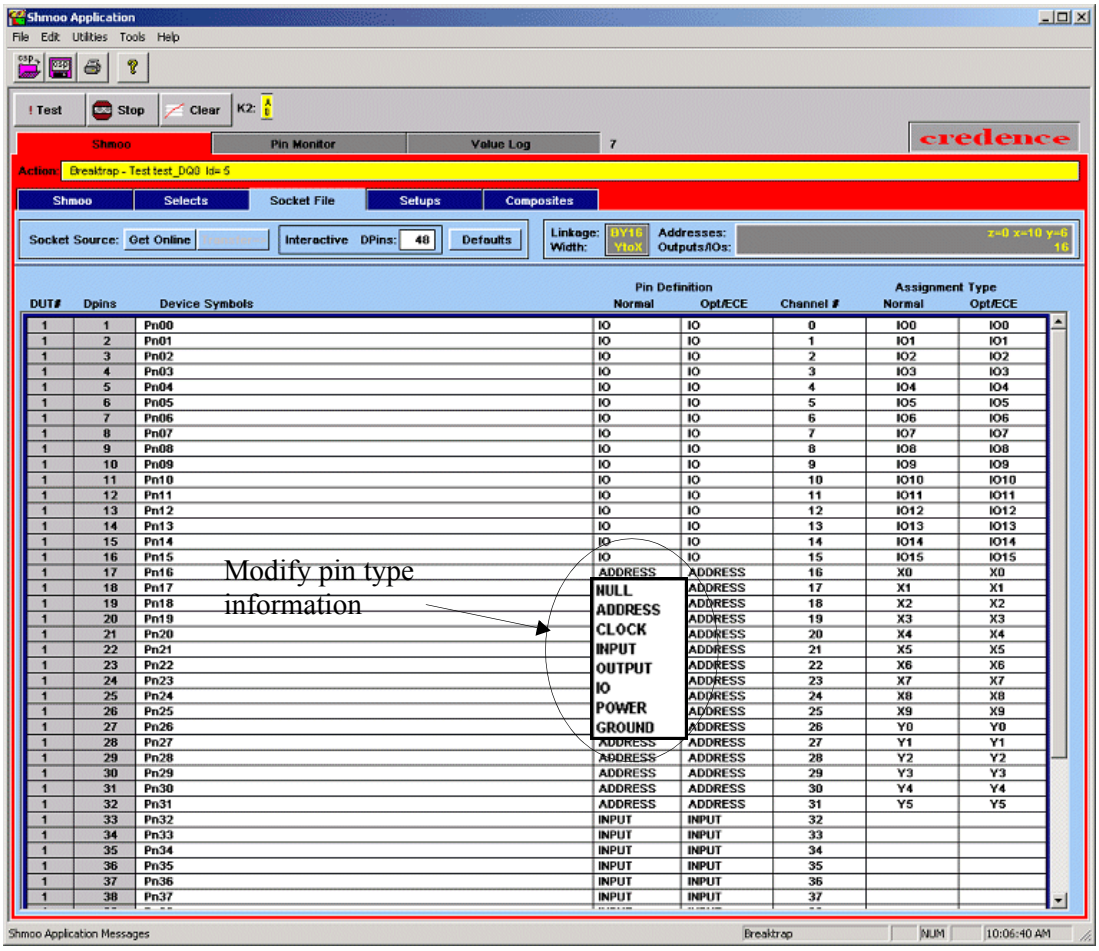
The Socket File (Default) property page, shown in Figure 254, provides a viewer that displays the socket definition of the initialized tool. Two other views are available under Socket File: Get Online and Interactive.

The default socket file has no relationship to any device type. Its primary use is to ensure that the application was initialized with predefined conditions: 16 IOs, 64 k of Addressing, and Device Symbols from Pn00 to Pn47.

To modify the name associated with a particular device pin, click the left mouse button in the Device Symbols column. Clicking the left mouse button in the Pin Definition column allows you to modify a pin's type, i.e., INPUT ADDRESS, NULL. The Assignment Type column allows you to modify the pattern generator assignment for a pin (see Figure 254).

The Interactive button provides the option of editing the internal shmoo socket table.

Figure 254. Socket File Property Page - Default With Interactive Enabled



NOTE — The Socket File, defaults, property page condition has no interactive control operations.

Online

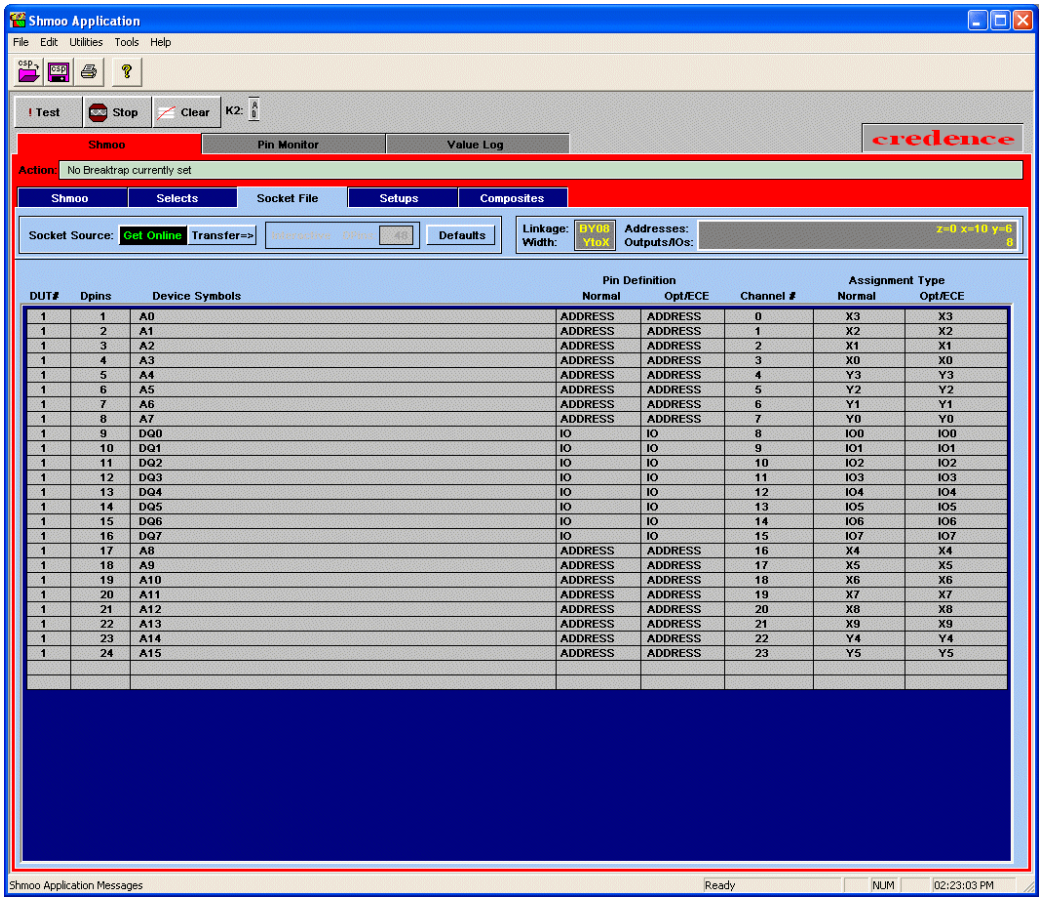
The Socket File (Online) property page, shown in Figure 255, provides a viewer that displays the socket definition of the currently loaded program file.

The online Socket File property page shown in Figure 255, as with most property pages, is divided into two areas. The control area and the display area. Note the displayed area is a read only interruption of the current socket file.

If you have clicked on the Get Online button to display the current property page, the Socket File display is the text view of the current socket file. The first three columns show the device information of DPin, Device Symbols and the type of function of the Dpin. Whereas the remaining columns show the Kalos 2 system definitions channel number, DPS number, ground, the channel type and address decoder assignment.

NOTE — The Socket File, Get Online, property page condition has no interactive control operations.

Figure 255. Socket File Property Page (Online)


Shmoo Application
File Edit Utilities Tools Help
Test
Stop
Clear
K2:
Shmoo
Pin Monitor
Value Log
credence
Action:
No Breaktrap currently set
Shmoo
Selects
Socket File
Setups
Composites
Socket Source:
Get Online
Transfer=>
Defaults
Linkage:
Width:
Addresses:
Outputs/IOs:
z=0 x=10 y=6
Pin Definition
Assignment Type
DUT# Dpins Device Symbols Normal Opt/ECE Channel # Normal Opt/ECE
1 1 A0 ADDRESS ADDRESS 0 X3 X3
1 2 A1 ADDRESS ADDRESS 1 X2 X2
1 3 A2 ADDRESS ADDRESS 2 X1 X1
1 4 A3 ADDRESS ADDRESS 3 X0 X0
1 5 A4 ADDRESS ADDRESS 4 Y3 Y3
1 6 A5 ADDRESS ADDRESS 5 Y2 Y2
1 7 A6 ADDRESS ADDRESS 6 Y1 Y1
1 8 A7 ADDRESS ADDRESS 7 Y0 Y0
1 9 DQ0 IO IO 8 IO0 IO0
1 10 DQ1 IO IO 9 IO1 IO1
1 11 DQ2 IO IO 10 IO2 IO2
1 12 DQ3 IO IO 11 IO3 IO3
1 13 DQ4 IO IO 12 IO4 IO4
1 14 DQ5 IO IO 13 IO5 IO5
1 15 DQ6 IO IO 14 IO6 IO6
1 16 DQ7 IO IO 15 IO7 IO7
1 17 A8 ADDRESS ADDRESS 16 X4 X4
1 18 A9 ADDRESS ADDRESS 17 X5 X5
1 19 A10 ADDRESS ADDRESS 18 X6 X6
1 20 A11 ADDRESS ADDRESS 19 X7 X7
1 21 A12 ADDRESS ADDRESS 20 X8 X8
1 22 A13 ADDRESS ADDRESS 21 X9 X9
1 23 A14 ADDRESS ADDRESS 22 Y4 Y4
1 24 A15 ADDRESS ADDRESS 23 Y5 Y5
Shmoo Application Messages
Ready
NUM
02:23:03 PM

Interactive

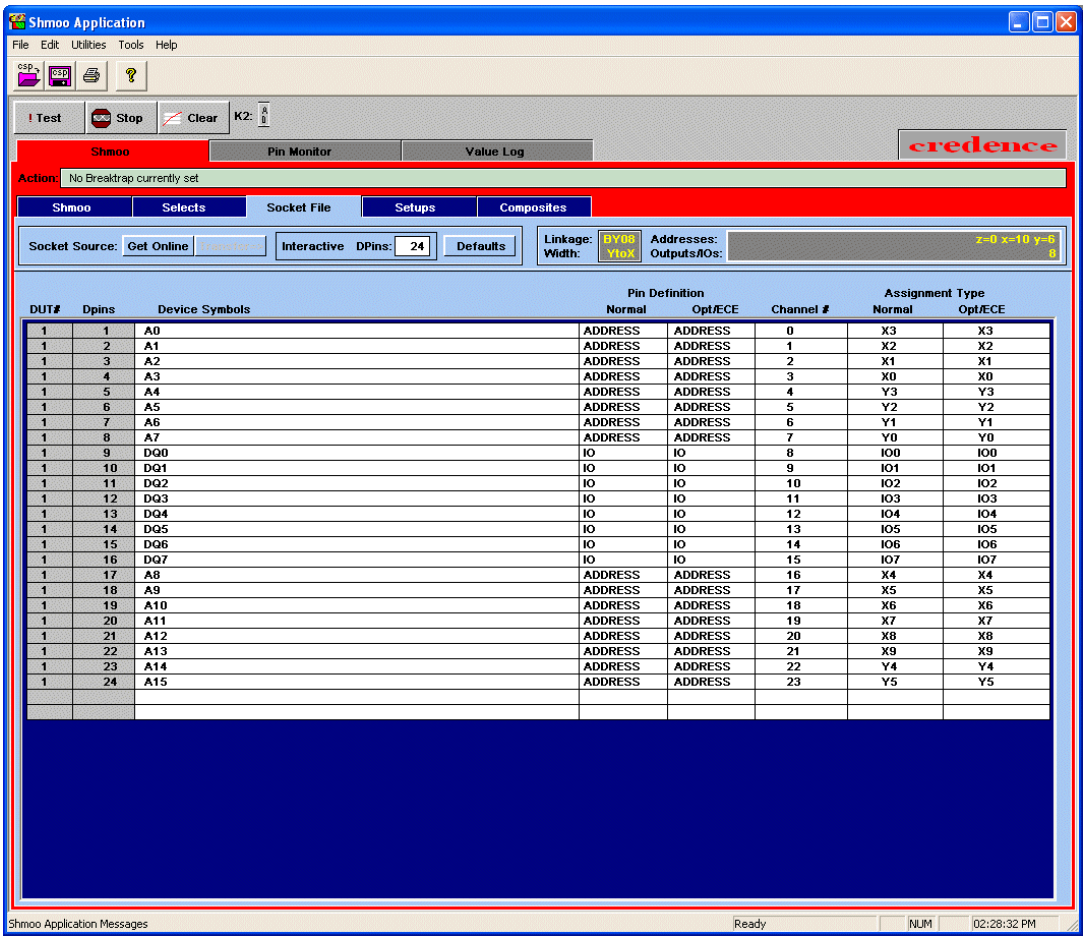
The Socket File (Interactive) property page, shown in Figure 256, provides a viewer for displaying the socket definition of a user generated socket file. This property page is selected by clicking on Get Online->Transfer=>.

The interactive socket file might not have a relationship to any device type. It has multiple uses, with the main use of reading a *.csp (extension for source setup parameter) file into the tool to check and ensure pin and/or pingroups are in sync in the Setups.

NOTE — The *.csp file extension can be used across Value Log, Bitmap, and Shmoo Plot tools/applications.

Besides providing a compare table for the internal checks, this property page allows for Offline generation of Setups with valid checking.

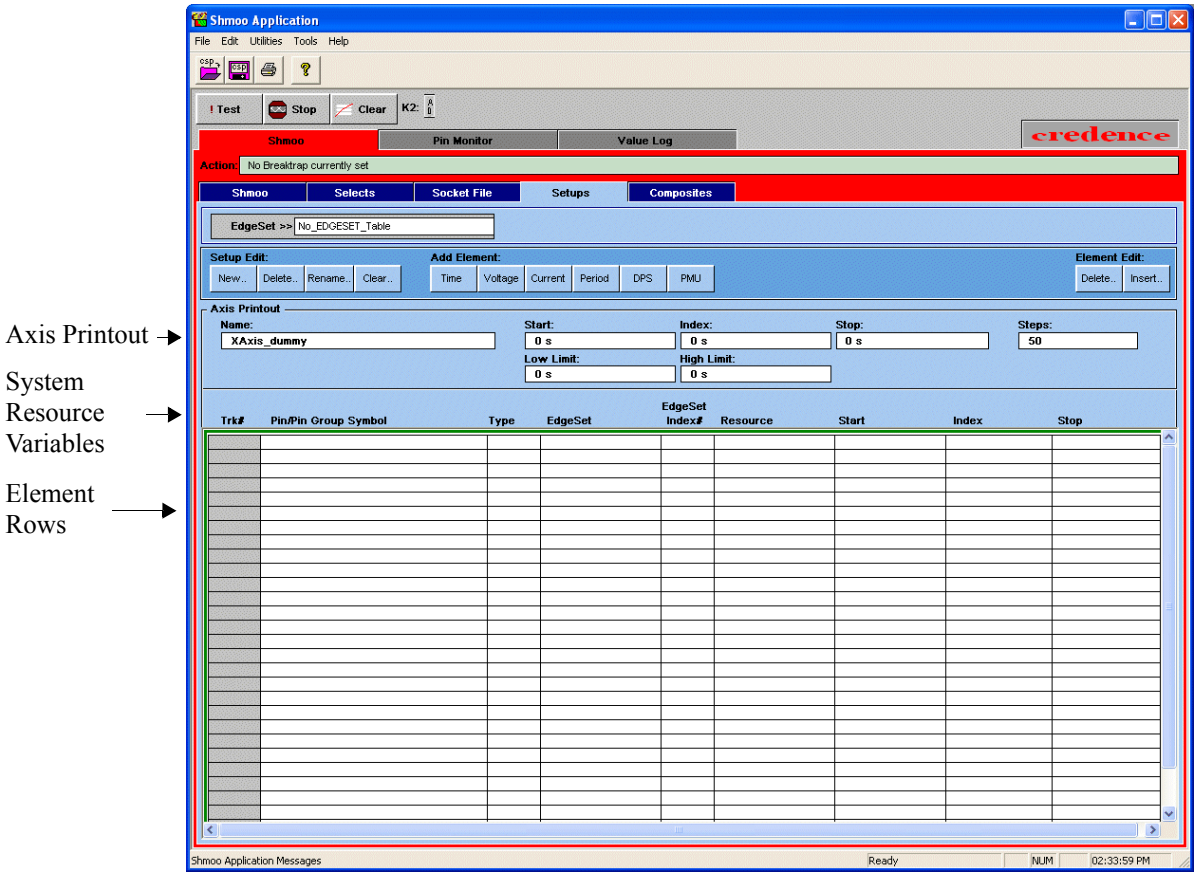
Figure 256. Socket File Property Page (Online->Transfer=>Interactive)



Setups Property Page

The Setups property page contains edit functions for defining variable setups for the X, Y, and Z axes. The Setups property page, shown in Figure 257, contains a spreadsheet with data fields for user input of values that define the variable setups. The variable setups are then used to set the axis selects conditions on the Selects property page.

Figure 257. Setups Property Page



The following Setup Edit operations are available for a selected setup. These operations are also available on the Edit menu option.

- New
- Delete
- Rename
- Clear

Add Element allows you to add another element in the table. The following Add Element operations can be selected (added to the elements row) by clicking on the desired button:

- Time
- Voltage
- Current
- Period
- DPS
- PMU

The minimum setup consists of the Axis Printout (METE) variables. These include parameter name, start value, index value, stop value, and number of datapoints (steps) to be executed from the start value. See Figure 257.

Every axis setup has two edit areas: axis printout and system resource variables. The difference being the axis printout is not system related, therefore the values are not checked for boundary limits.

New, Delete, Rename, or Clear operations for the selected setup are accomplished by way of the menu bar->Edit selection or by way of the pop-up menu, activated by right mouse clicking in the table area.

Modification of the element row contents is performed by way of pulldown lists and/or text edit boxes. Both are activated by a single left mouse click in the respective table area.

NOTE — As with all Kalos 2 applications, any field that is white in color can be edited, while grayed-out fields or options are either read-only or unavailable.

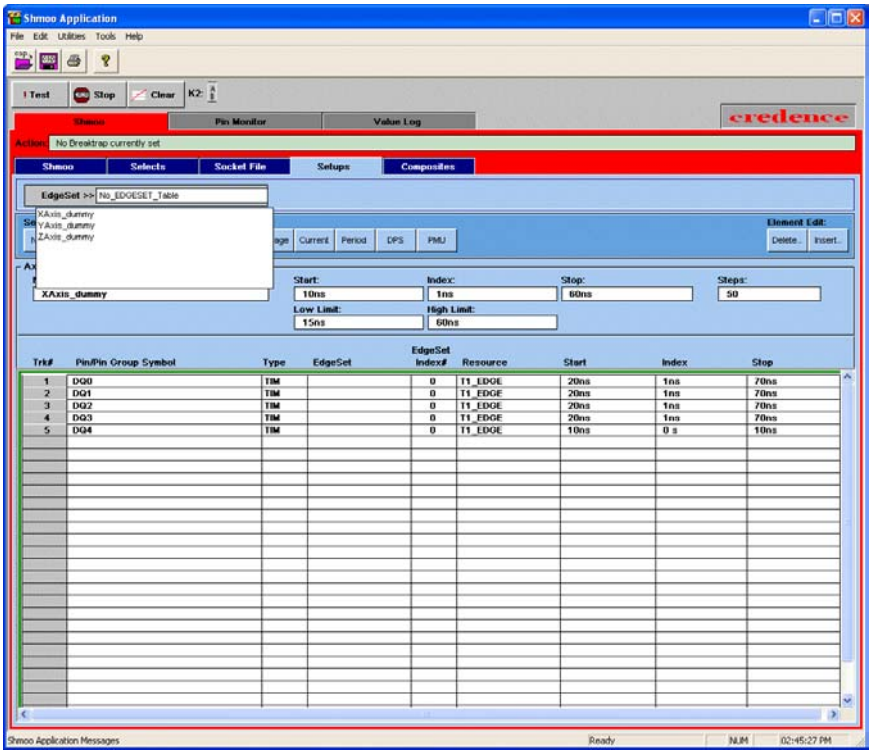
The METE and all tracking parameters have individual start, index, and stop values with a common steps value. Although they all have entry points, only the following equation is used for each parameter entry: start value plus index value times step number equals the stop value.

The assumption is if the user wants to control the parameter range by inputting the stop value (instead of the index value), then the step number must be entered before any stop value entrees. Changing the step number and/or the index values change the respective stop value(s).

Figure 258 shows an example of an expanded complex setup with multiple device (system resources) variables. Elements 1 through 4 illustrate the use of device pin (DPin) symbols, whereas a pingroup can be substituted for these device pins (if so defined). Either way is acceptable.

The Element Edit: Delete... option allows you to delete any element in the table. The Insert... option allows you to insert an element before any other element.

Figure 258. Property Page - Setup Example

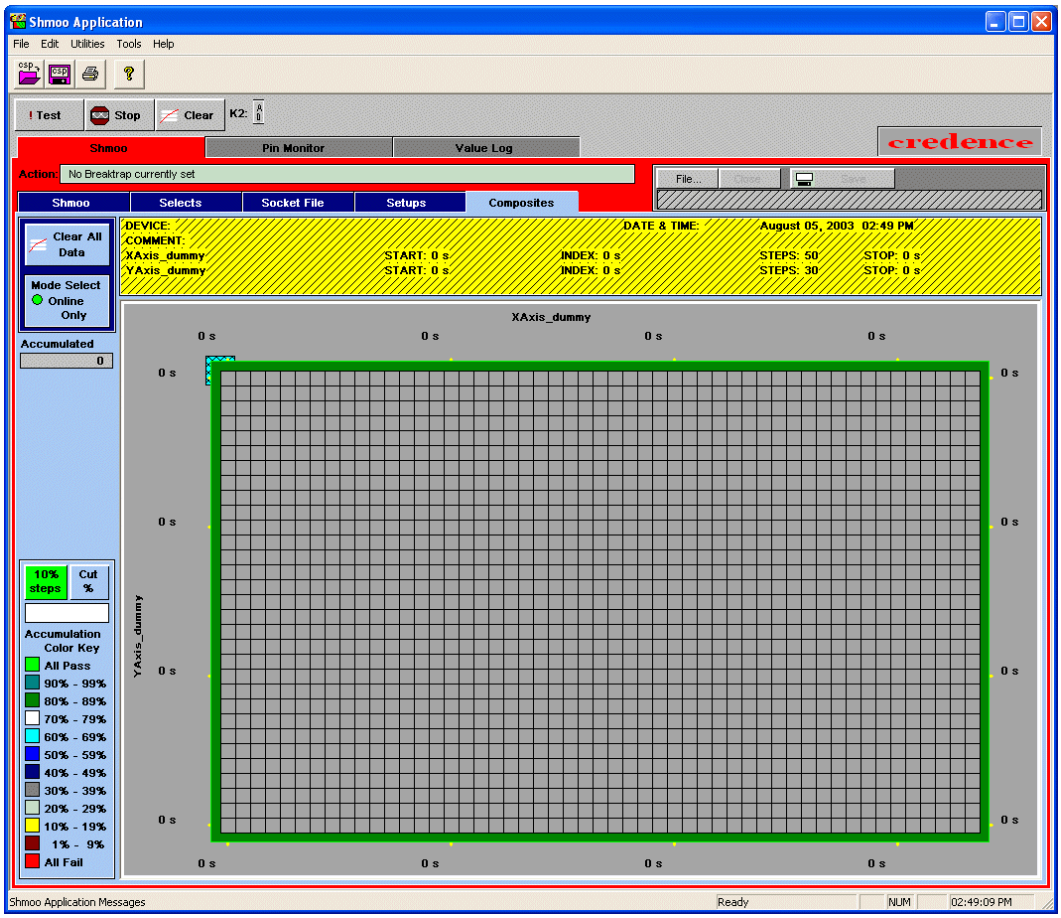


Composites Property Page (Accumulate Mode)

The Composites property page allows users to enable or disable the accumulate modes (see Figure 259). These modes are selected by clicking on the *Accumulate* toggle button in the Shmoo Display property page. Enabling this button allows you to display accumulated shmoo data in the Composites property page. The total number of devices currently accumulated is shown in the far left in the control area of the Composites property page. This counter increments only if the mode is enabled, the selected comparison status is equal, and the selected shmoo plot is completed.

Two types of accumulate views are available: accumulate percent (10% steps) and threshold by categories (cut %). Threshold by categories considers the input value as a cut off figure and anything below it as a failed datapoint. Its view has a status zero pass, less than the value and equal or greater than the value. Percentage view is displayed by values of ten.

Figure 259. Composites Property Page



Online Operations

Online is the normal operational mode. In this mode, the software interacts with the tester hardware. Tests programmed by the user supply the pass/fail criteria and system resource setups.

ASCII or Screen Print Operations

Shmoo plots may be output to a printer or file, in ASCII or color hard copy. Color hard copy may include the entire Shmoo Application window or a specified region of the window. For color copies, use *Ctrl + Alt + Print Screen* to save the output to the clipboard. A third party software application (e.g., Paint) must be used to paste the content of the clipboard, then print the color copy to a printer.

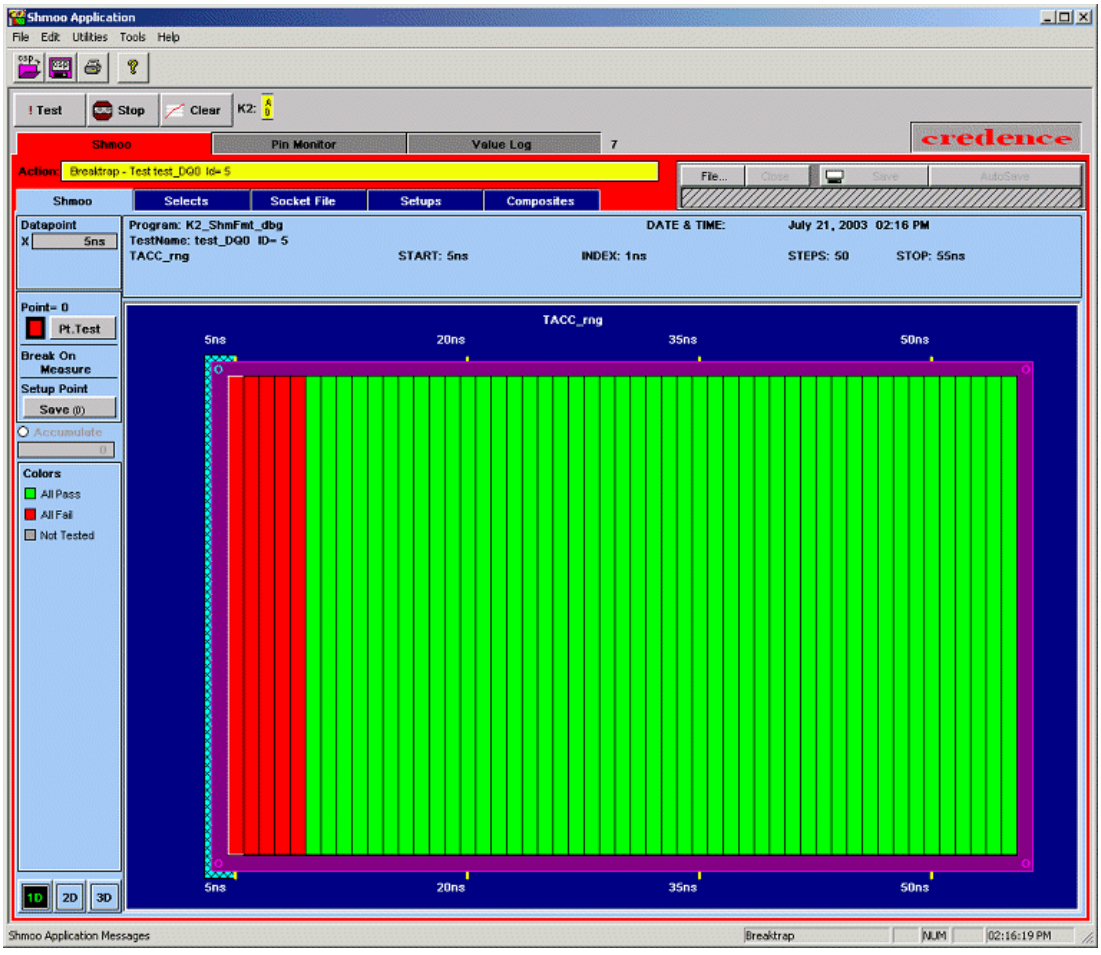
One-Dimensional Shmoo Plot

The 1-D Shmoo consists of a selected variable setup executed across a specified range, with the resulting pass/fail region displayed as a one line plot along the X-axis. Options include selected pass datapoint skipping, and all accumulation modes.

Including the original datapoint, the minimum number of datapoints in the axis direction is two and the maximum number is 101 (origin and steps: steps 1 to 100).

Figure 260 shows a single DUT, 1-D Shmoo plot. This is considered to be a normal 1-D Shmoo.

Figure 260. 1-D Normal Shmoo



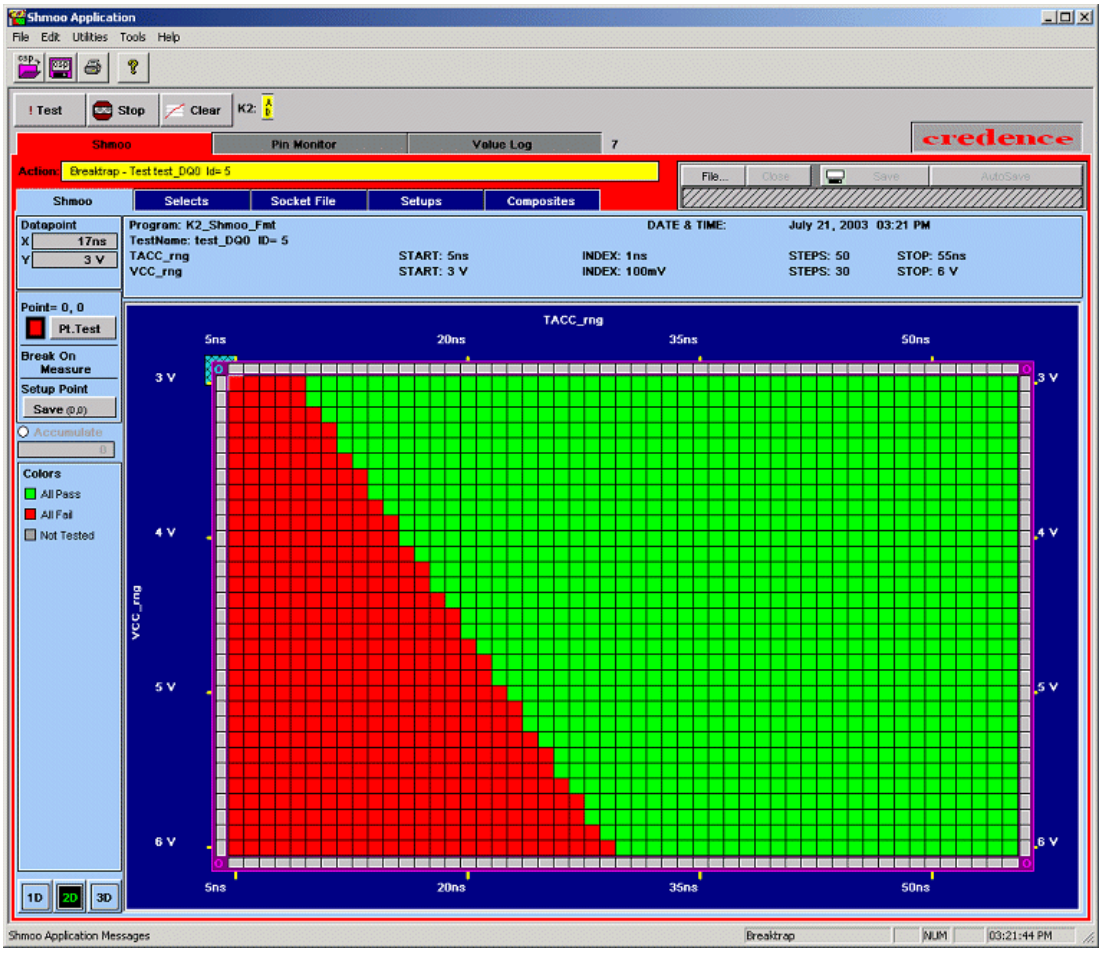
Two-Dimensional Shmoo Plot

A 2-D Shmoo plot consists of two selected variable setups executed across their respective ranges, with the resulting pass/fail regions displayed on a 2-D coordinate system. Options include interpretation of the fail datapoints, selected pass datapoint skipping, and all accumulation modes.

Including the original datapoint, the minimum number of datapoint in either axis direction is two and the maximum number is 101 (origin and steps: steps 1 to 100).

Figure 261 illustrates a single DUT 2-D Shmoo plot. This is considered to be a normal 2-D Shmoo.

Figure 261. Normal 2-D Shmoo Plot



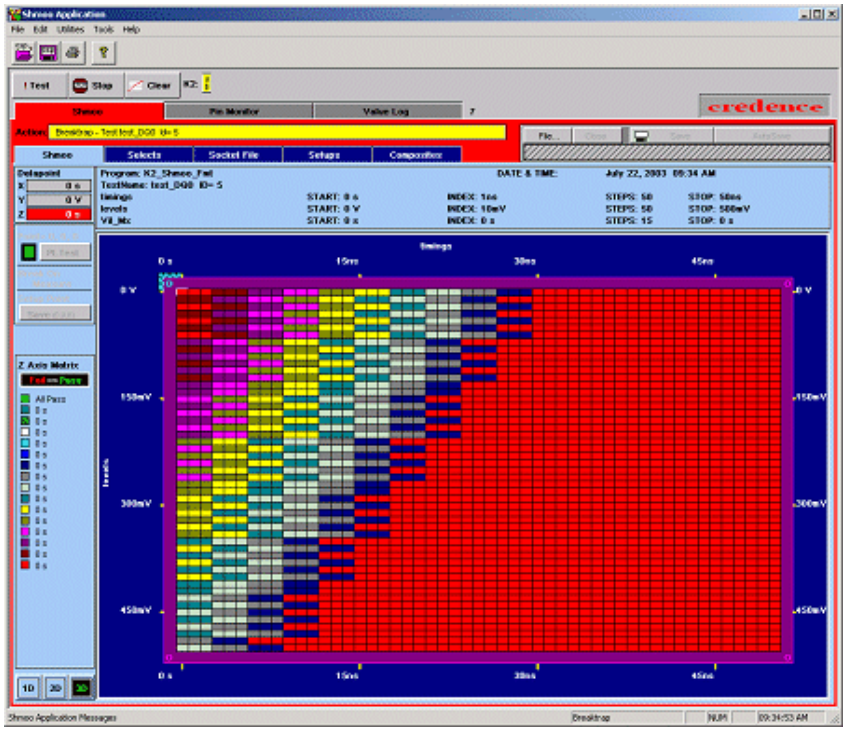
Three-Dimensional Shmoo Plot

A 3-D Shmoo consists of three selected variable setups executing the assigned X and Y variables across their respective ranges, with the third variable, Z, executing either a fail to pass or pass to fail selection. Variable setups defined for 1-D or 2-D plots are available for the 3-D plot.

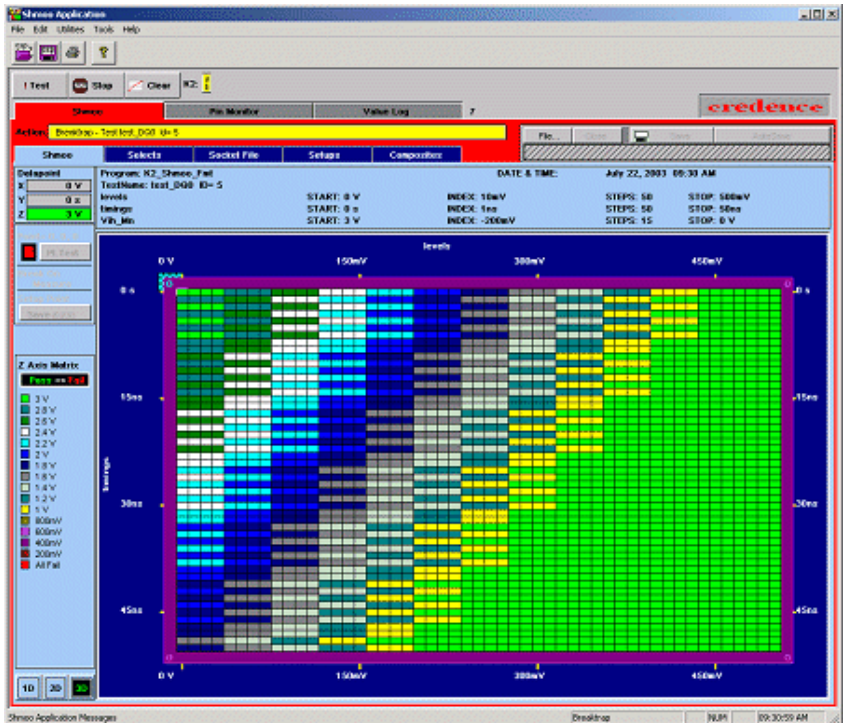
An example of a standard 3-D Shmoo is shown in Figure 262.

Figure 262. Standard 3-D Shmoo Plot

3-Dimensional shmoo fail to pass



3-Dimensional shmoo pass to fail



None of the following options, defined for plots in one and two dimensions, are available for 3-D plots.

- Pass-skip. The pass-skip number is forced to the value of 1.
- Accumulate mode.

Including the original datapoint, the minimum number of datapoint in either axis direction is two and the maximum number is 101 (origin and steps: steps 1 to 100).

Color assignments for the 3-D Shmoo are determined by a threshold value. The reason for this is after the pass/fail/not tested color assignments are made, only 10 available colors are left. The threshold value acts like a slide bar. All steps below the threshold are represented by one color, and all steps above the threshold are represented by another color. The steps between the threshold values are then assigned unique colors.

PMU and DPS Plots

PMU and DPS XY plots are supported with Kalos 2 release.

Accumulate Mode

Accumulate mode is a background operation for accumulating multiple 1-D or 2-D Shmoo plots. This mode is selected by clicking on the Accumulate toggle button in the Shmoo Display property page. The resulting accumulation can be displayed interactively at any specified time.

When accumulate mode is enabled, the current status of the accumulated data is displayed in the shmoo graphic area. The total number of devices accumulated is shown below the Accumulate button. This counter increments only when the following is true.

- Accumulate mode is enabled.
- The selected comparison status is equal.
- The selected shmoo plot is completed.

Two types of accumulate plots are available: accumulate percent and threshold by categories. Each is shown in Figure 263 and Figure 264.

Figure 263. Accumulate Passed Percentage Plot

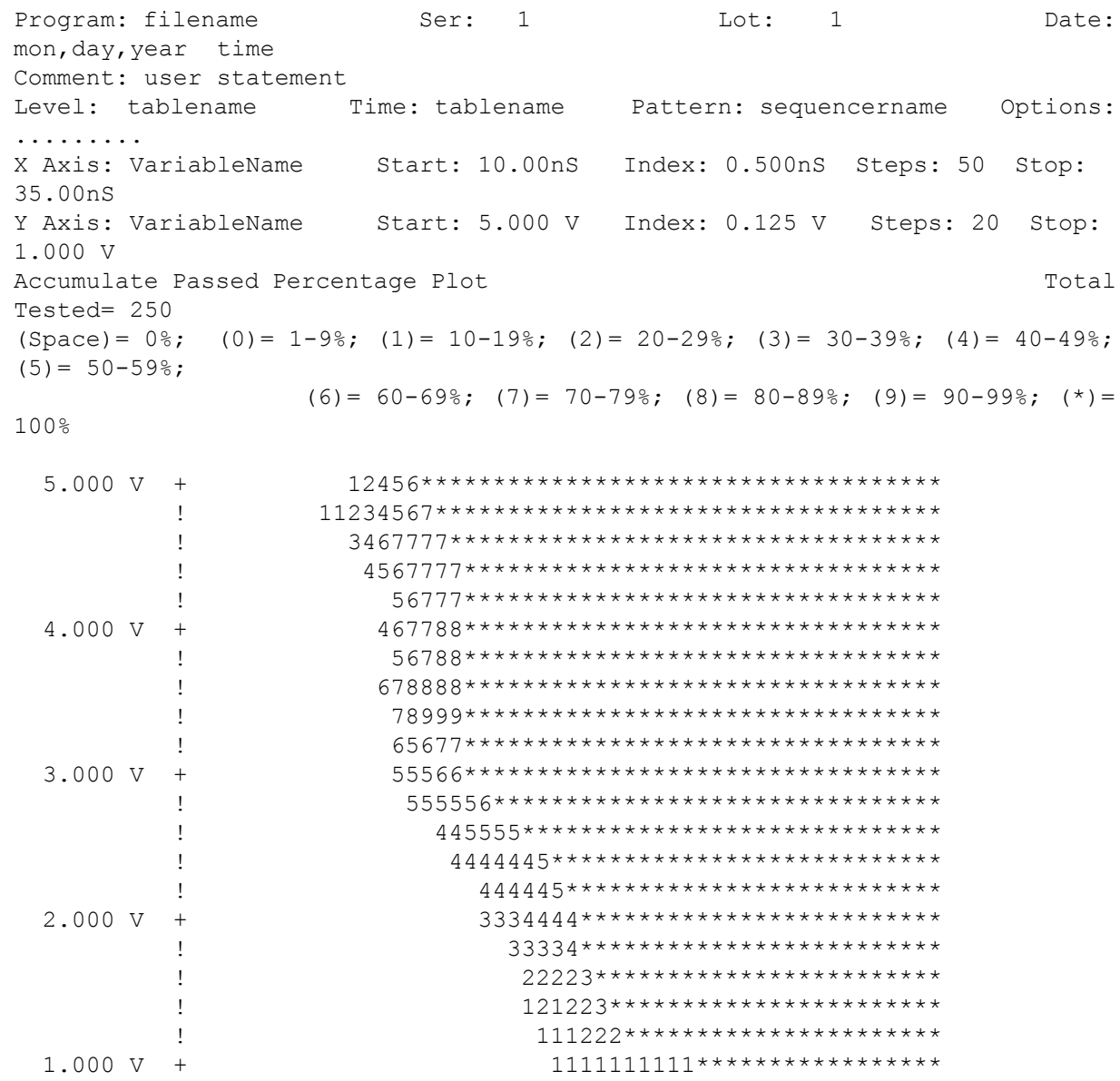
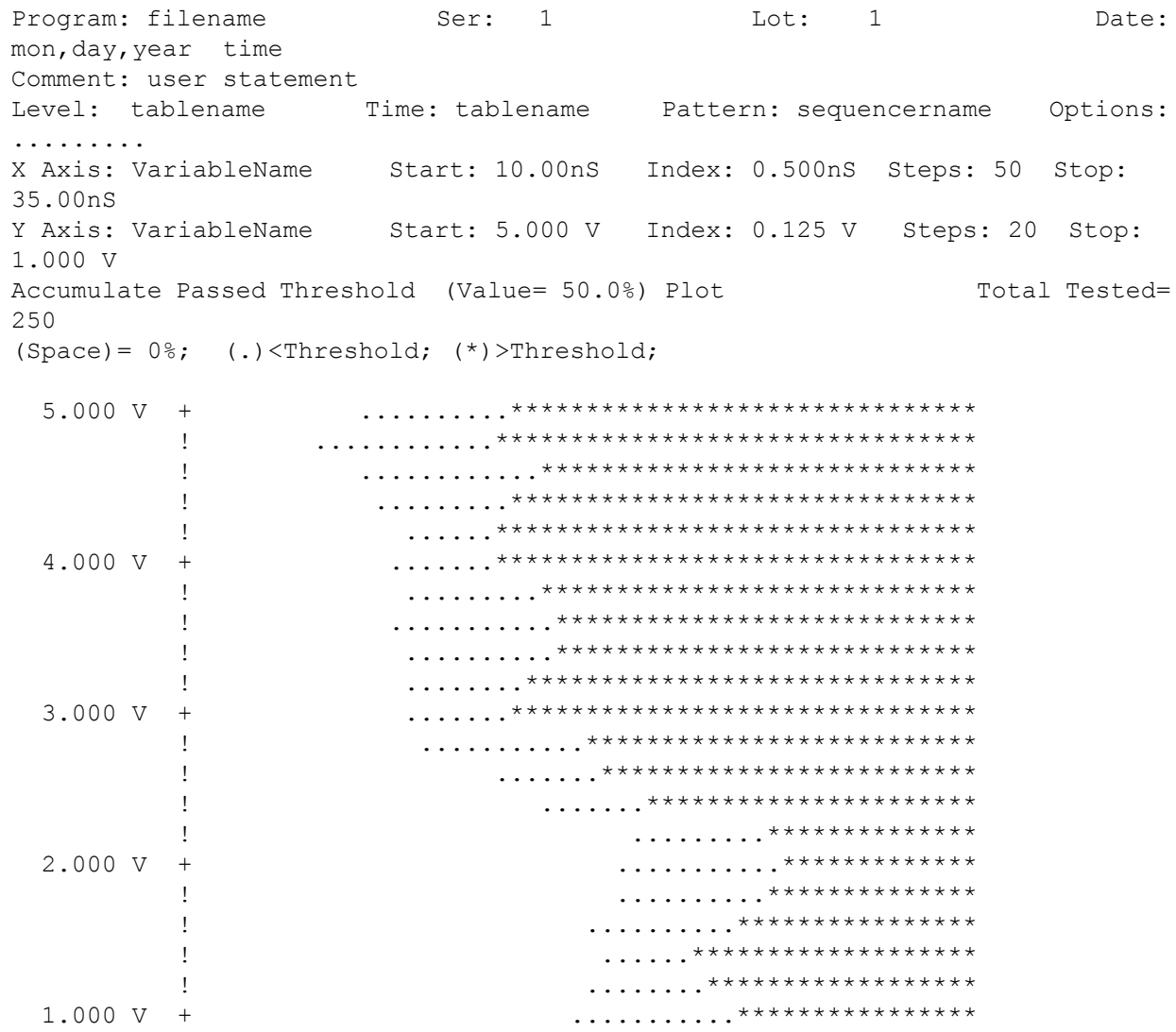

Program: filename Ser: 1 Lot: 1 Date: mon,day,year time
Comment: user statement
Level: tablename Time: tablename Pattern: sequencername Options: .....
X Axis: VariableName Start: 10.00nS Index: 0.500nS Steps: 50 Stop: 35.00nS
Y Axis: VariableName Start: 5.000 V Index: 0.125 V Steps: 20 Stop: 1.000 V
Accumulate Passed Percentage Plot Total Tested= 250
(Space)= 0%; (0)= 1-9%; (1)= 10-19%; (2)= 20-29%; (3)= 30-39%; (4)= 40-49%; (5)= 50-59%;
(6)= 60-69%; (7)= 70-79%; (8)= 80-89%; (9)= 90-99%; (*)= 100%
5.000 V
4.000 V
3.000 V
2.000 V
1.000 V

Figure 264. Accumulate Passed Threshold Plot (Value = 50%)



ASCII Printout Examples

Figure 265 through Figure 271 are examples of ASCII shmoo plots which utilize the different options available for execution modes, and multiple DUT data gatherings for 1-D, 2-D, 3-D and, PMU plots.

1-D and 2-D Plots

Figure 265. Basic 2-D (Default Setup)

```
Program: filename              Ser:   1               Lot:    1
Date: mon,day,year  time
Comment: user statement
Level:  tablename         Time: tablename         Pattern: sequencername
Options: ........
X Axis: VariableName       Start: 10.00nS    Index: 0.500nS    Steps: 50
Stop: 35.00nS
Y Axis: VariableName       Start: 5.000 V    Index: 0.125 V     Steps: 20
Stop: 1.000 V

5.000 V  +            ****************************************
         !             ***************************************
         !              **************************************
         !               *************************************
         !               *************************************
         !               *************************************
4.000 V  +               *************************************
         !               *************************************
         !               *************************************
         !               *************************************
         !               *************************************
         !               *************************************
3.000 V  +                 ***********************************
         !                  **********************************
         !                   *********************************
         !                    ********************************
         !                     *******************************
2.000 V  +                      ******************************
         !                      ******************************
         !                       *****************************
         !                        ****************************
         !                         ***************************
1.000 V  +                            ************************
```

Figure 266. Pass Skip 2-D (1 < PSkip# < XSteps)

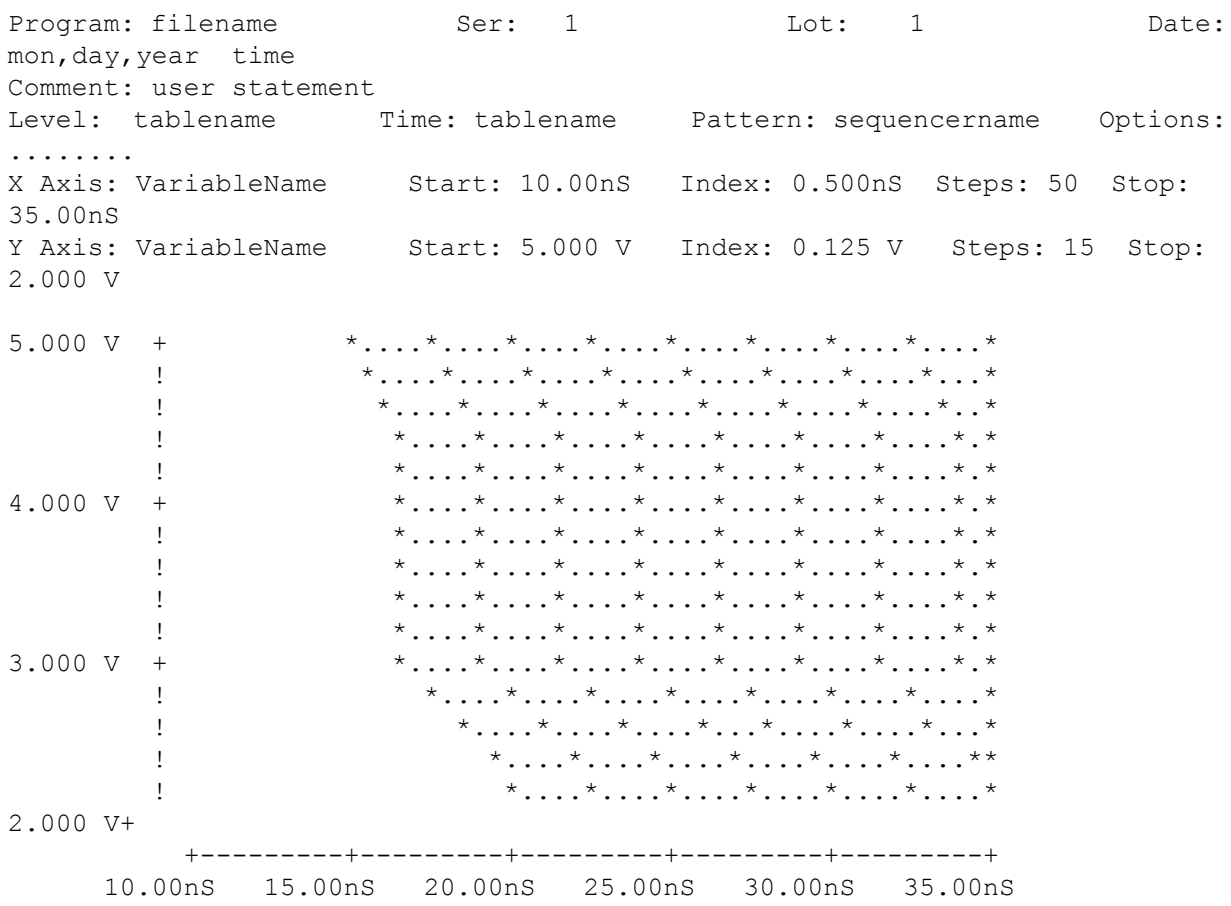


Figure 267. Boundary Shmoo (PSkip >= XSteps)

```
Program: filename           Ser:   1            Lot:    1             Date:
mon,day,year  time
Comment: user statement
Level:  tablename      Time: tablename     Pattern: sequencername    Options:
........
X Axis: VariableName     Start: 10.00nS   Index: 0.500nS  Steps: 50  Stop:
35.00nS
Y Axis: VariableName     Start: 5.000 V   Index: 0.125 V   Steps: 20  Stop:
1.000 V

5.000 V  +           *.....................................*
         !            *.....................................*
         !             *.....................................*
         !              *.....................................*
         !                *.....................................*
4.000 V  +                *.....................................*
         !                *.....................................*
         !                *.....................................*
         !                *.....................................*
         !                *.....................................*
3.000 V  +                 *.....................................*
         !                   *.....................................*
         !                      *.....................................*
         !                      *.....................................*
         !                       *.....................................*
2.000 V  +                        *.....................................*
         !                       *.....................................*
         !                        *.....................................*
         !                         *.....................................*
         !                          *.....................................*
1.000 V  +                              *.....................*
           +---------+---------+---------+---------+---------+
      10.00nS   15.00nS   20.00nS   25.00nS   30.00nS   35.00nS
```

3-D Plots

Figure 268. 3-D Fail to Pass

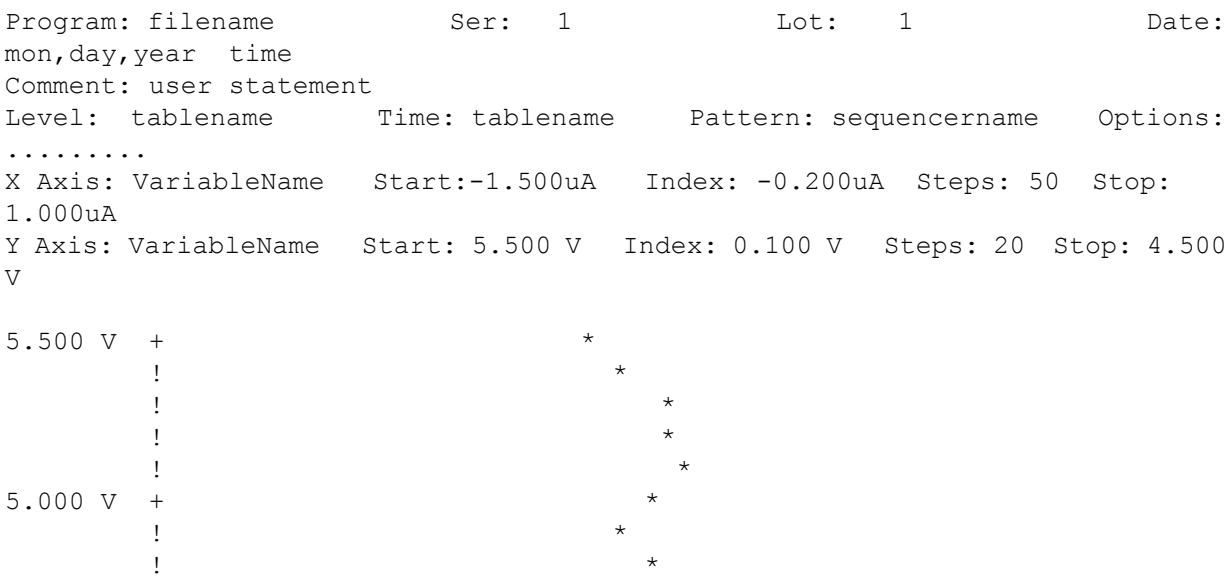
```
Program: filename           Ser:   1            Lot:    1             Date:
mon,day,year  time
Comment: user statement
Level:  tablename      Time: tablename     Pattern: sequencername    Options:
........
X Axis: VariableName     Start: 10.00nS   Index: 0.500nS  Steps: 50  Stop:
35.00nS
Y Axis: VariableName     Start: 5.000 V   Index: 0.125 V   Steps: 15  Stop:
2.000 V
Y Axis: VariableName     Start: 1.500 V   Index: 0.100 V   Steps: 10  Stop:
2.500 V
Fail to Pass 3D Shmoo Plot
( )= All Fail;    (1)= 1.600 V; (2)= 1.700 V; (3)= 1.800 V; (4)= 1.900 V; (5)=
2.000 V;
(*)= All Pass;   (6)= 2.100 V; (7)= 2.200 V; (8)= 2.300 V; (9)= 2.400 V; (0)=
2.500 V

  5.000 V  +     22222211111************************************
           !       2222111111************************************
           !         333222211************************************
           !           33333332***********************************
           !           54333333***********************************
  4.000 V  +          555544433***********************************
           !           55555544***********************************
           !            6655555***********************************
           !            666555555*********************************
           !             76755555*********************************
  3.000 V  +             8877666*********************************
           !              9888877********************************
           !                9888888*******************************
           !                 99999987*****************************
           !                   999098*****************************
  2.000 V  +                     000999888888888888*************
```

Figure 269. 3-D Pass to Fail

```
Program: filename           Ser:   1            Lot:    1             Date:
mon,day,year  time
Comment: user statement
Level:  tablename      Time: tablename     Pattern: sequencername    Options:
........
X Axis: VariableName     Start: 10.00nS   Index:  0.500nS  Steps: 50  Stop:
35.00nS
Y Axis: VariableName     Start: 5.000 V   Index:  0.125 V   Steps: 15  Stop:
2.000 V
Y Axis: VariableName     Start: 2.500 V   Index: -0.100 V   Steps: 10  Stop:
1.500 V
Pass to Fail 3D Shmoo Plot
( )= All Fail;    (1)= 2.400 V; (2)= 2.300 V; (3)= 2.200 V; (4)= 2.100 V; (5)=
2.000 V;
(*)= All Pass;   (6)= 1.900 V; (7)= 1.800 V; (8)= 1.700 V; (9)= 1.600 V; (0)=
1.500 V

  5.000 V  +     888888999**********************************
           !       8888999999********************************
           !         777888999********************************
           !           77777778*******************************
           !           66777777*******************************
  4.000 V  +          555566667*******************************
           !           55555566*******************************
           !            4444555*******************************
           !             444555555*****************************
           !              34335555*****************************
  3.000 V  +              2233444******************************
           !               1121333*****************************
           !                 1122222***************************
           !                  11111112*************************
           !                    001111*************************
  2.000 V  +                      00011111122222222************
```

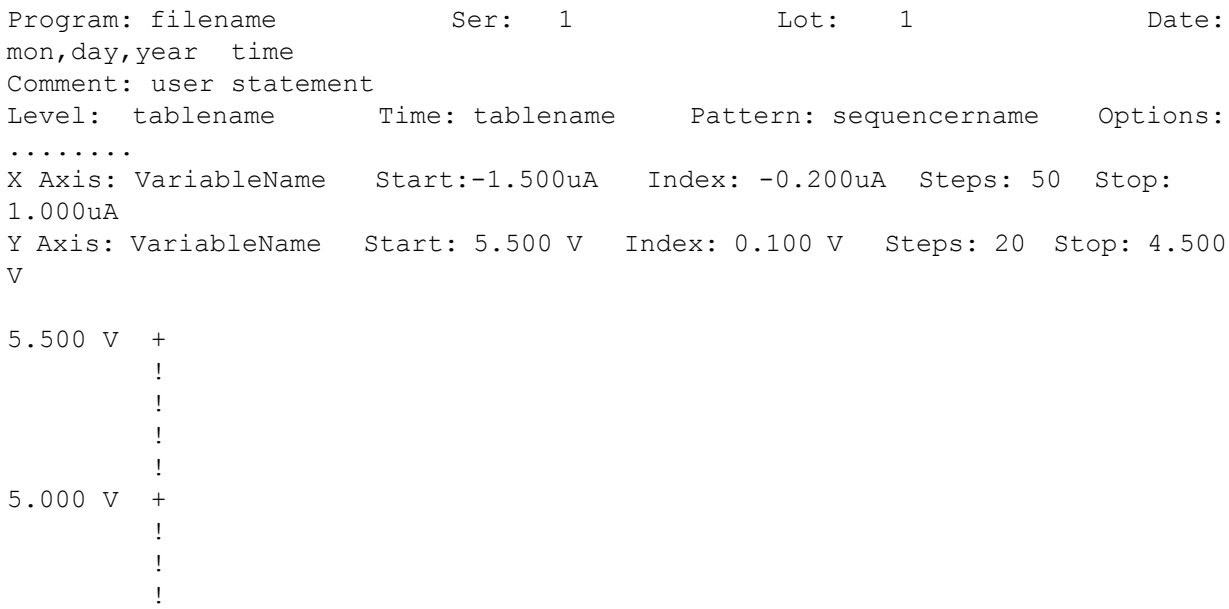
PMU XY Plots

Figure 270. PMU XY Plot


Program: filename Ser: 1 Lot: 1 Date: mon,day,year time
Comment: user statement
Level: tablename Time: tablename Pattern: sequencername Options: .....
X Axis: VariableName Start:-1.500uA Index: -0.200uA Steps: 50 Stop: 1.000uA
Y Axis: VariableName Start: 5.500 V Index: 0.100 V Steps: 20 Stop: 4.500 V
5.500 V
5.000 V

PPMU Plots

Figure 271. PPMU XY Plot (Leakage)


Program: filename Ser: 1 Lot: 1 Date: mon,day,year time
Comment: user statement
Level: tablename Time: tablename Pattern: sequencername Options: .....
X Axis: VariableName Start:-1.500uA Index: -0.200uA Steps: 50 Stop: 1.000uA
Y Axis: VariableName Start: 5.500 V Index: 0.100 V Steps: 20 Stop: 4.500 V
5.500 V
5.000 V

Shmoo Plot Example

The following are the specifications for the shmoo plot example used in this section:

Device used: 28F016SV 16-MBIT (1 MBIT x16) FlashFile™ MEMORY

X-axis variables: PINGROUP DBUS = Pins DQ0...DQ15

NOTE — In KTL (Kalos Test Language), a PINGROUP can contain one or several pins. After a pingroup is defined, it can be used as a shorthand approach (shortcut) for referring to several related pins.

Y-axis variables: VCC_1

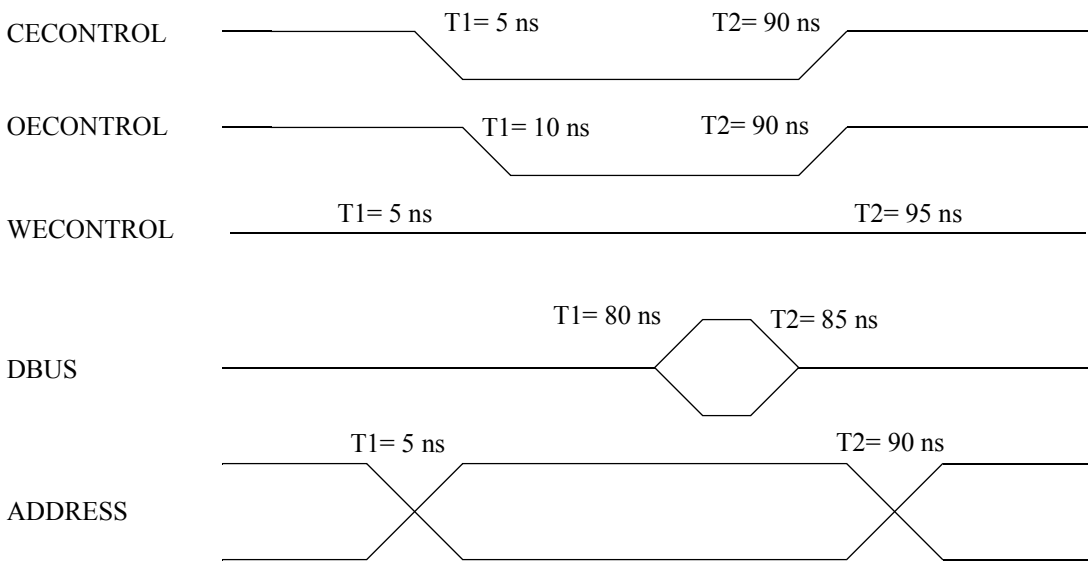
Parameter tested: t_{ACC} = t_{AVQV} = time(t) from address (A) valid (V) to the outputs (Q) becoming valid (V).

Datasheet specification: t_{AVQV} (max) = 70ns.

Implementation

1. The following example is the method used to Breaktrap on the read_AAAA_fast pattern.
2. Figure 272 illustrates the timing diagram of the read cycle in the read_AAAA_fast pattern.

Figure 272. Read Cycle of read_AAAA_fast (Period is Set to 200 ns)



The timing, format, and period for the cycle shown in Figure 272 are defined in the section of the KTL program quoted in the following KTL Program Segments: TSET, FSET, PSET.

```
TSET tset4 = {
  DESC = "tset for read ";
  CECONTROL={
  T1 = 5ns;
    T2 = 90ns;
    };
  OECONTROL={
    T1 =  10ns;
    T2 = 90ns;
    };
  WECONTROL={
    T1 = 5ns;
    T2 = 95ns;
    };
  DBUS={
    T1 = 80ns;
    T2 = 85ns;
    };
  ADDRESS={
    T1 = 5ns
    T2 = 90ns;
    };
};
```

```
......
......
  FSET fset6 = {
   DESC = "fset for read ";
  CECONTROL={
     F1 = G2L;
     F2 = G2H;
     };
  OECONTROL={
     F1 = G2L;
     F2 = G2H;
     };
  WECONTROL={
     F1 = G2H;
     F2 = G2H;
     };
  DBUS={
     F1 = ED;
     F2 = DC;
     };
  ADDRESS={
     F1 = G2D;
     F2 = G2D;
     };
  };
.....
.....
PSET pset2 = {
     DESC = "pset for read tests";
     MAIN = 200ns;
     ALT = 200ns;
};
```

3. Create a shmoo plot to measure the minimum value of the address access time t_{ACC}.

   In order to achieve this, the DBUS pingroup on the X-axis must be moved from 85 ns (t_{ACC} = 80 ns) to 45 ns (t_{ACC} = 40 ns).

Vary the value of VCC on the Y-axis from 2.5 V to 5 V.

4. Step 1: Before launching the Shmoo tool (application), the user must Breaktrap on the read_AAAA_fast test.

   In the Engineering property page of Front Panel, select **BreakMeas.** Then in **BreakOnTest** field: select the read_AAAA_fast test. Press Start button for the test program to execute.

   Step 2: From Front Panel, launch the Shmoo tool by selecting *Tools* => *Shmoo* from the menu bar.

Step 3: Once the Shmoo tool window is open, click on the Socket File property page tap, then click on the Get Online button to load the test program socket table into the Shmoo application.

Step 4: Click on the Property page tab marked Setups.

Step 5: Select Edit => New Setup from the menu bar. Enter `TAA_neg_index` for the name of this setup table.

In Figure 272, the read cycle of read_AAAA_fast pattern illustrates that the strobe occurs at 80 ns. Therefore, in order to measure the minimum t_{ACC} of the 16 M device, the user must move the edge of the DBUS, in negative time, from 85 ns to 45 ns. By moving the edge of the DBUS in this manner, t_{ACC} varies between 80 ns and 40 ns (offset of 5 ns from address TI).

Next select *Edit => Add Time Element*. Under Pin/Pin Group Symbol, select DBUS. Under *Type*, select TIM. Under *Set#*, select 3. Under *CycleName*, select read_tight_cycle. In KTL the TSET used is tset4 (Sets in shmoo are defined as Set#0, Set#1, Set#2 and so on. TSETs in KTL are defined as tset1, tset2, tset3 and so on. Therefore, Set#3 in the Shmoo tool corresponds to tset4 in KTL).

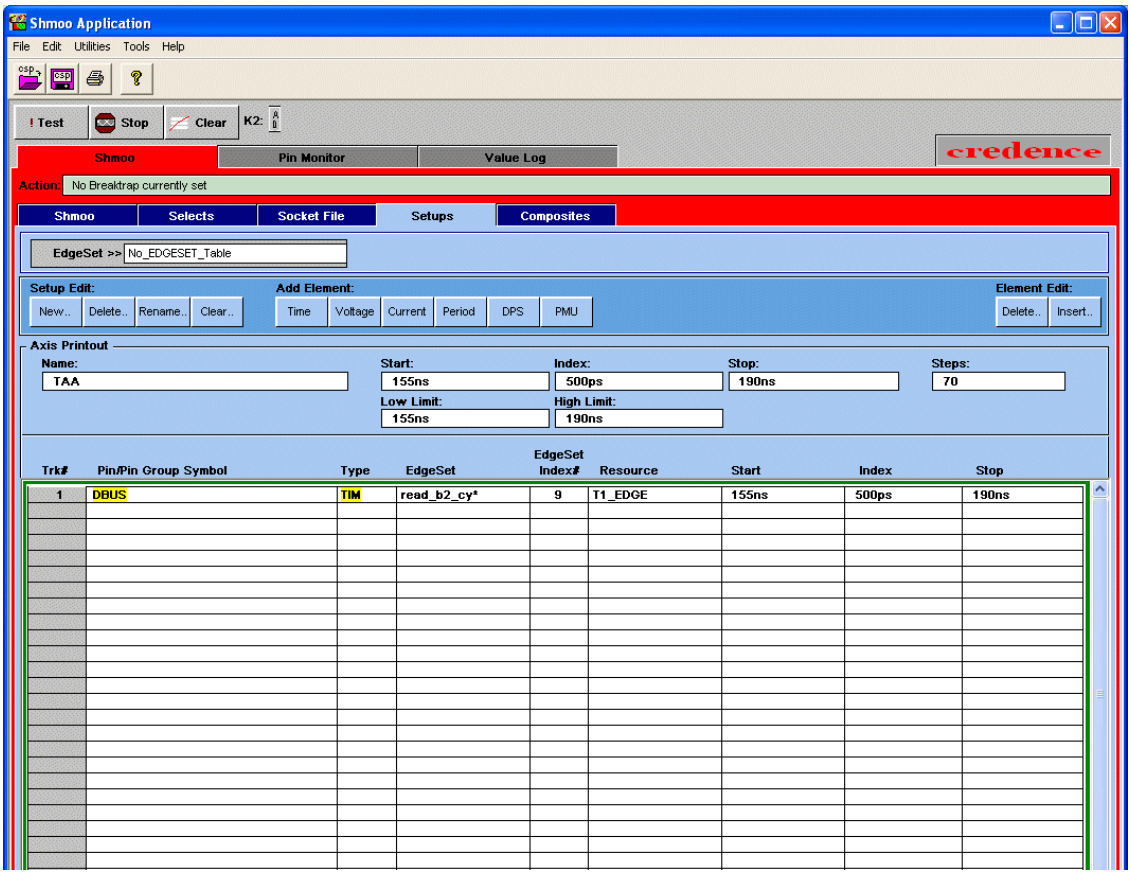
Under Resource, select T1_EDGE. Under Start, enter `85 ns` (t_{ACC} =80 ns). Under Index, type `-2ns`. This moves the edge backward 2 ns for each shmoo point. The Stop is grayed-out because it is a view only field.

Next enter the Axis Printout Start value, Index value and steps. For this example, set the Start value to 80 ns, set the Index value to -2 ns, and set the number of Steps to 20.

NOTE — The difference between the Axis Printout (Name, Start value, Index value, Steps) and the System Resource Variables (Pin/Pin Group Symbol, Type, Set#, Resource, Start, Index, Stop) is the Axis Printout is not system/hardware related. It simply defines the X and Y axis of the Shmoo display. In this example, the Axis Printout index and the System Variable index are both set to 2 ns.

The TAA_neg_index setup is shown in Figure 273.

Figure 273. t_{ACC}_neg_index Setup



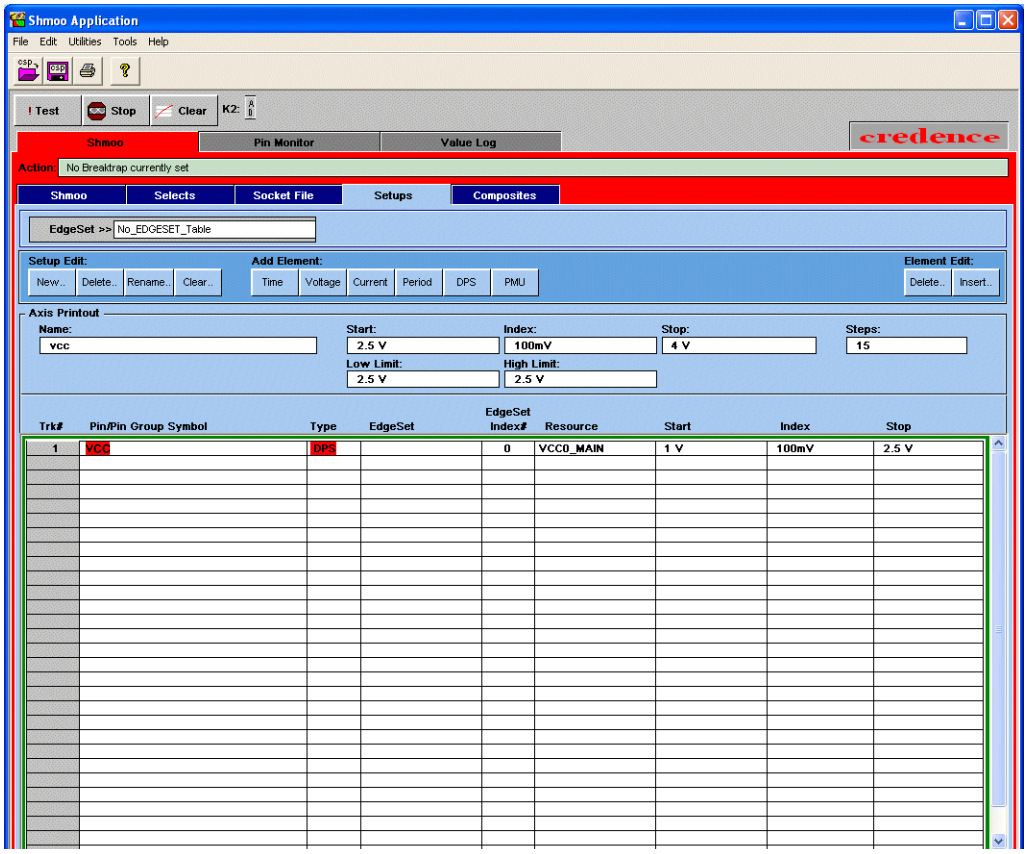
Step 6: Next select Edit=> New Setup from the menu bar in order to enter VCC for the name of the second setup table.

Then select Edit-> Add DPS Element. Under Pin/Pingroup Symbol, select VCC_1 and under Type, select DPS. Under Set#, 0 is now the only selection available since the DPS resource is independent of the tsets inside the KTL program. Under Resource, select VCC0_MAIN. Under Start, type `2.5 V`. Under Index, type `100mV`. The Stop is grayed-out because it is a view only field.

Next enter the Axis Printout Start value, Index value, and Steps. For this example set the Start value to 2.5 V, set the Index value to 100 mV, and set the number of Steps to 25.

The VCC setup is shown in Figure 274.

Figure 274. VCC Setup



Step 7: Now that Setups are defined, select the Selects property page which allows the user to define a.) the XY origin (Top Left, Bottom Left, Top Right, Bottom Right), b.) the Type of shmoo (1D, 2D, 3D), and c.) which pre-defined variable Setup (from Steps 5 and 6) to plot on the X and Y axis.

a.) For the XY origin, click on the box labeled Bottom Left Corner.

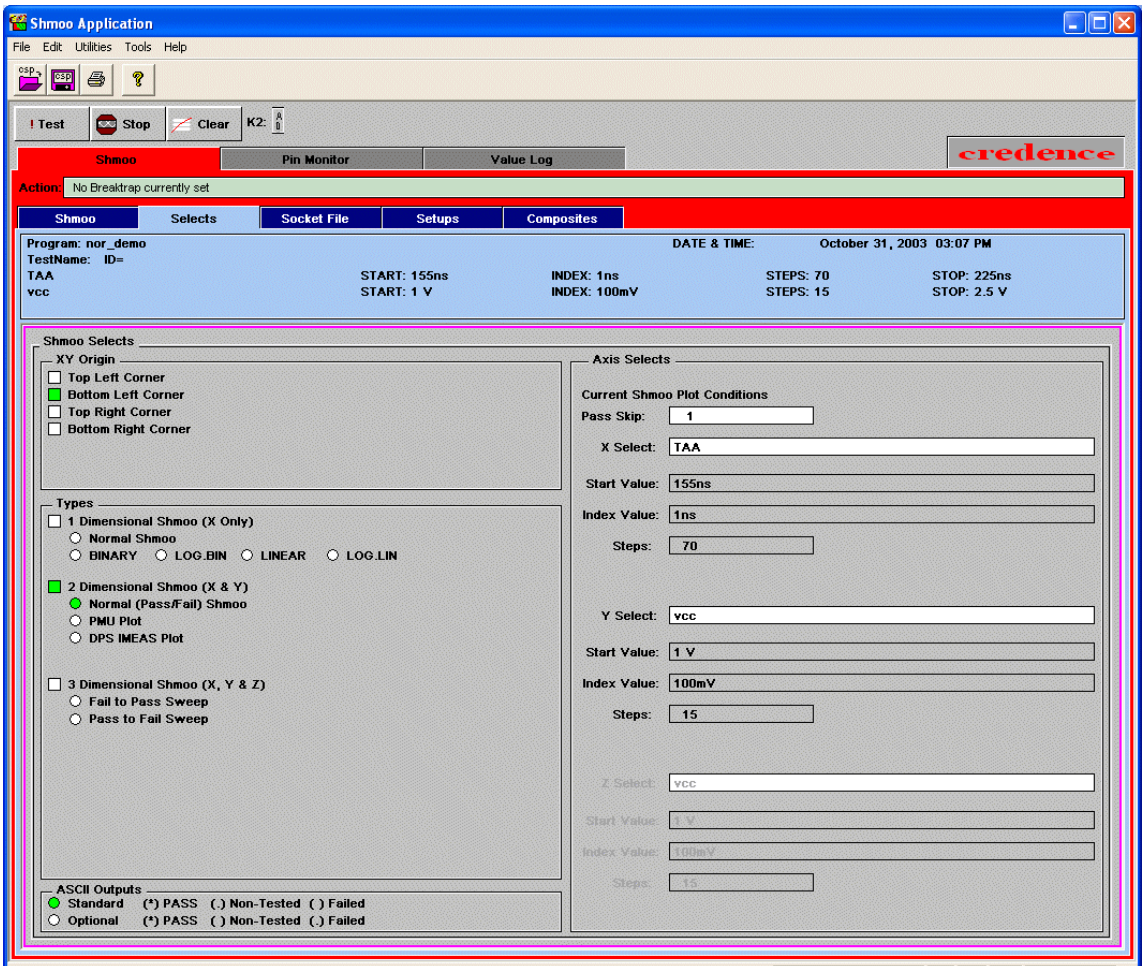
b.) Under Types, select the 2Dimensional Shmoo.

c.) In the Axis selects section, set the Pass Skip number to 1 and choose TAA_neg_index for the X Select and VCC for the Y Select.

NOTE — Pass Skip number: controls the skip datapoints between the pass points. For example, if Pass Skip is set to 5, then the Shmoo keeps testing until it finds the first pass. Then it will not test the next five datapoints. If the fifth datapoint tested is a pass, then once again the next five datapoints are not tested (the system assumes the points not tested are passing datapoints). If however, the fifth datapoint tested is a fail, the system goes back to test every point that it skipped in the last five datapoints until it finds another passing datapoint, at which time the skipping process starts again.

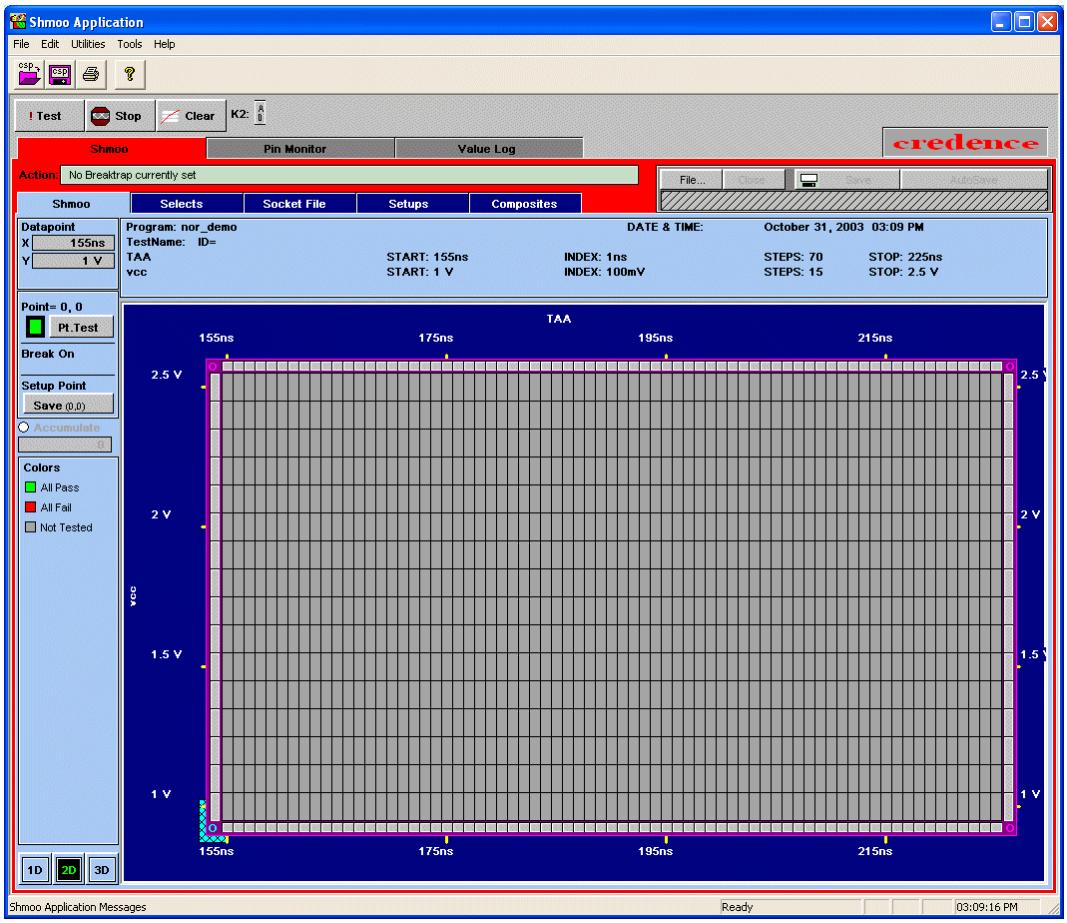
The Select Property page is shown in Figure 275.

Figure 275. Selects Property Page



Step 8: Now that the Setups and Selects are defined, click on the Shmoo display property page. Once the Test button is pressed, the shmoo plot executes. Any given point on the plot results in either a Pass, Fail, or Pass-Skip and is represented by a matrix color on the grid display. Pass points are shown in green and Fail points are shown in red. Figure 276 shows the shmoo execution results of this example.

Figure 276. Shmoo Display



5. From the shmoo plot, note the access time t_{ACC} of the 16 M device at room temperature and at VCC=5 V is 50 ns.
6. In order to save the Setup to a File, select File=> Export Setups.
7. The shmoo plot can be printed by selecting Print from the File menu item.

Pin Monitor

Pin Monitor is an application which allows the user to evaluate the performance of a DUT on a per pin basis. The evaluation is performed by creating one dimensional shmoo plots of each resource that is allocated to a pin. This provides detailed resource marginality information of the device, and is also helpful in debugging applications.

In order to use the Pin Monitor application, a breaktrap is set in the Front Panel on a functional test. Refer to Example 1, page 503, for information on breaktrap setting.

The Pin Monitor application is separated into the following six tabs:

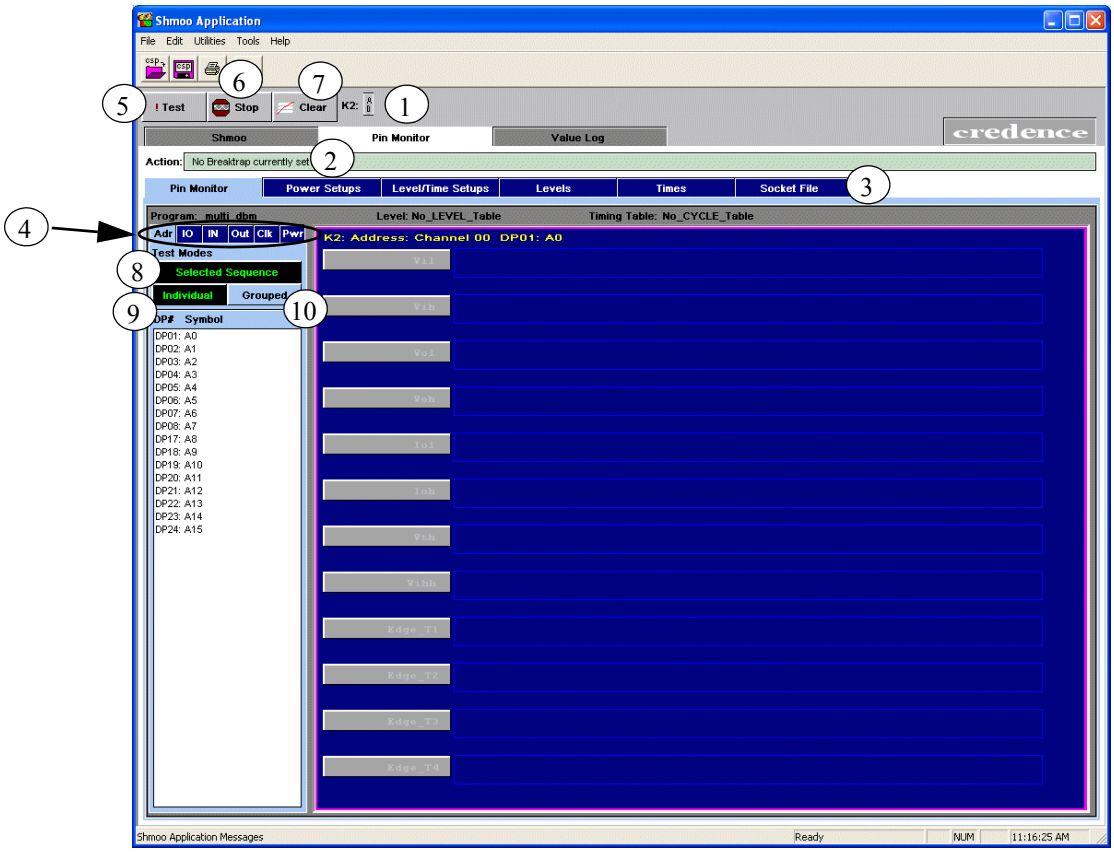
1. Pin Monitor tab
2. Power Setup tab
3. Level/Time Setup tab
4. Level tab
5. Times tab
6. Socket tab

When selected, each tab provides a viewer (window) for the respective selection of the application. A description of each viewer follows.

Pin Monitor Window

The Pin Monitor window is used to view the shmoo plots that are generated by the tool. This window is divided into six subtabs which organize the tester channels type. The user may generate the plots by individual channel or as a group (see Figure 277).

Figure 277. Pin Monitor Window



Following is the description of each individual field of the Pin Monitor window:

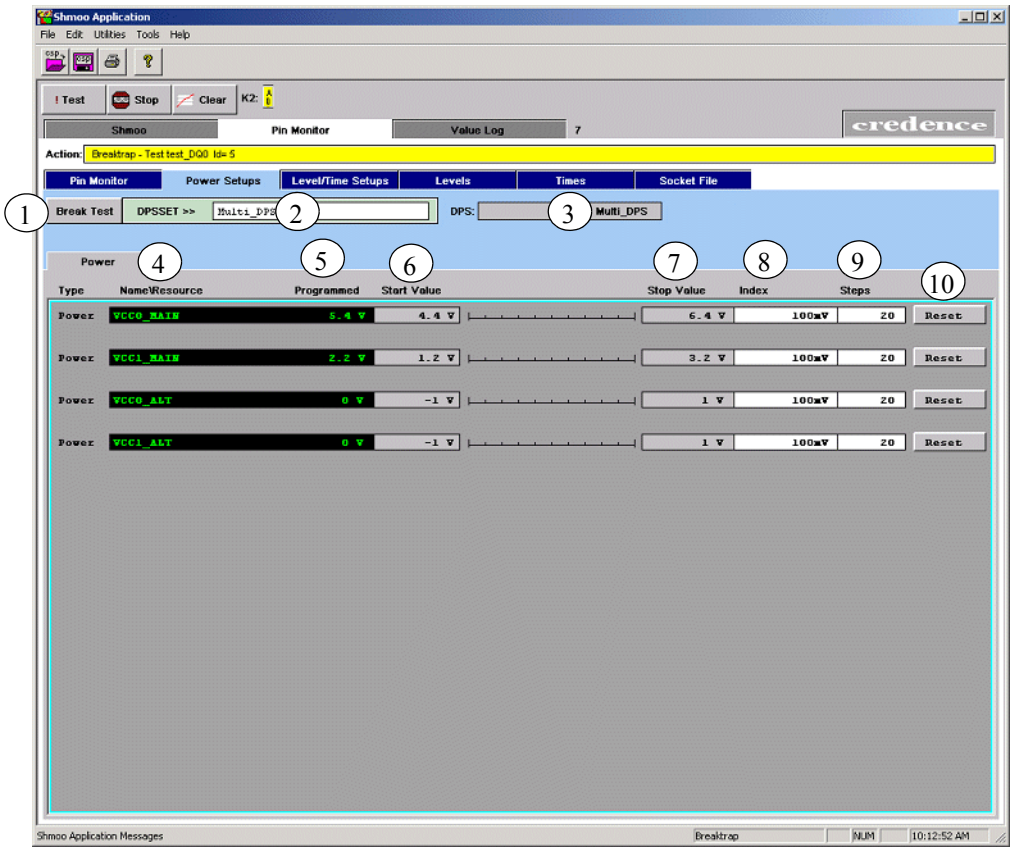
1. Slices - shows the slice number on which the breaktrap is set.
2. Action - shows the test on which the breaktrap is set.
3. Pin Monitor Tab Selection **-** opens the window for the selected tab.
4. Pin Type - perform a test on a pin of that type by selecting one of these tabs. The tester channels are organized by the pin types.
5. Test - initiates testing of each resource for the selected pin after shmoo setups are created.
6. Stop - stops a test in progress.
7. Clear All - clears the results of a previous test.
8. Select Sequence - switches between Selected and Auto Sequence. When a test is initiated from Selected Sequence, the test is only performed on the selected pin. When a test is initiated from Auto Sequence, the test is performed one at a time on each pin of the selected pin type.

9. Individual - performs the test using one pin at a time.
10. Grouped - tests evaluate a resource by taking all pins into account. That is, all pins are tested at the same time and affect the outcome of a single result. To view the results, the pin that was selected when the test was initiated must remain selected.

Power Setups Window

The Power Setups window helps in characterizing device performance based on DUT power levels. Select the DPSSET used by the test on which the breaktrap is set. If the test explicitly defines a DPSSET, then choose the Break Test button (see Figure 278). If no DPSSET is defined and it is inherited from a previous test, then select the DPSSET manually. Once the DPSSET is selected, the tool automatically creates shmoo setups for the power pins on a per pin basis. These setups are based on the default values of the tool, but may be modified by the user (see Figure 278).

Figure 278. Power Setups Window



Following is the description of each individual field of the Power Setups window:

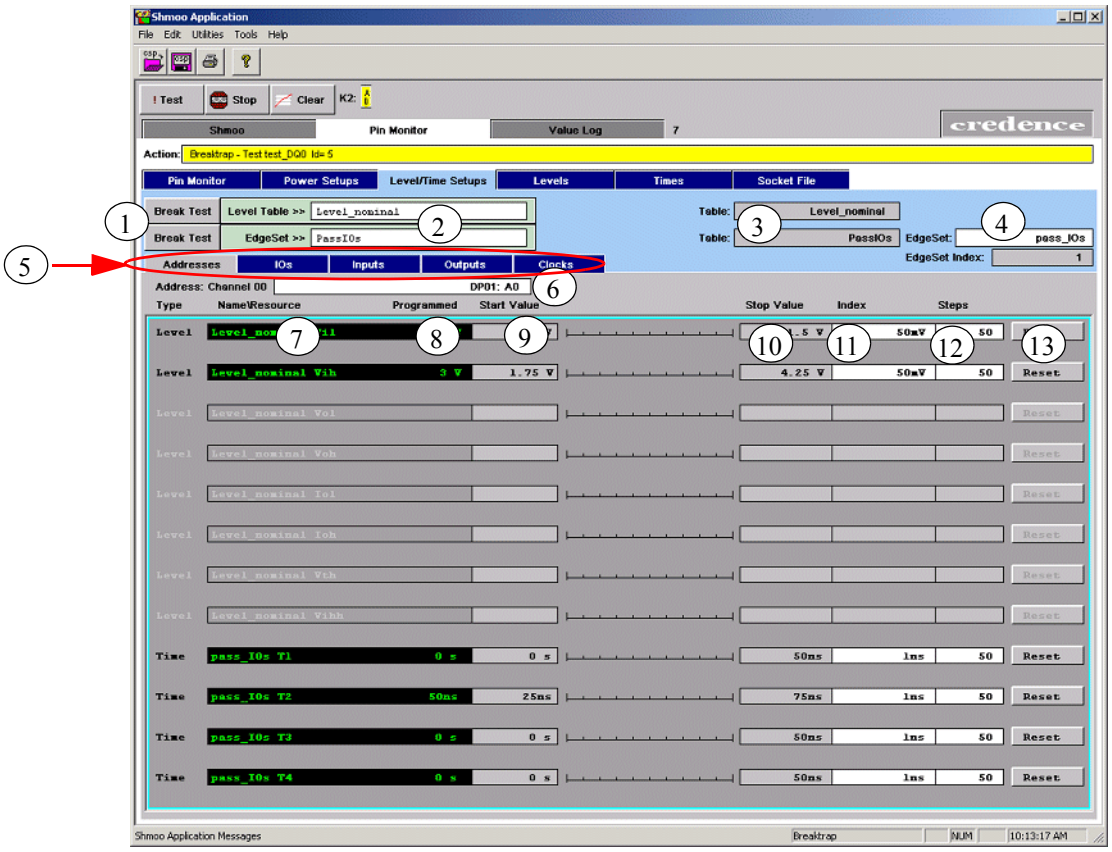
1. Break Test - switches between Break Test and DPSSET. When Break Test is selected, Pin Monitor retrieves the KTL programmed DPSSET from the test program. If DPSSET is selected, manually select the DPSSET.
2. Break Test/DPSSET - when Break Test is selected, this window acts as read only and displays the DPSSET retrieved from the test program. If DPSSET is selected, a drop-down menu appears. The user must use this drop-down menu to select the DPSSET used by the breaktrap.
3. DPS - shows currently selected DPSSET.
4. Names/Resources - shows the power supplies that are defined in that DPSSET.
5. Programmed - shows the value programmed in the test program for the respective power supply.
6. Start Value - shows the starting value of the shmoo, determined by the index and number of steps with the programmed value at the midpoint.
7. Stop Value - shows the stopping value of shmoo, determined by the index and number of steps with the programmed value at the midpoint.
8. *Index - when a DPSSET is selected, shmoo setup is generated based on the default index value, however the user may change the value by selecting one of the predefined values in this window.
9. *Steps - when a DPSSET is selected, shmoo setups are generated based on the default value of steps, however the user may change the value by selecting one of the predefined values in this window.
10. Reset button - returns the Index and Steps windows to the default values.

NOTE — * Only index and steps can be changed.

Level/Time Setups Window

Level/Time Setups window allows the user to select the cycle and levels with which Pin Monitor generates the shmoo plots. Once this information is input, Pin Monitor automatically creates generic setups on a per pin basis for each resource that a pin is allocated to in the KTL program. These values may be adjusted manually on a per channel basis. This tab is separated into five subtabs which organize the channels by pin type for easier use, as shown in
Figure 279.

Figure 279. Level/Time Setups Window



Following is the description of each individual field of the Level/Time Setups window:

1. Break Test button - switches between Break Test and Level Table or EdgeSet respectively. When Break Test is selected, Pin Monitor retrieves the KTL programmed Level Table and EdgeSet from the test program. If Level Table or EdgeSet is selected, manually select the Level Table or EdgeSet.
2. BreakTest/Level /EdgeSet - when Break Test is selected, these windows act as read only and display the Level Table or EdgeSet retrieved from the test program. If Level Table or EdgeSet is selected, a drop-down menu appears. The user must use this drop-down menu to select the Level Table or EdgeSet used by the breaktrap.
3. Table - shows the current Level Table and EdgeSet.
4. EdgeSet - select the EdgeSet on which the breaktrap is set.
5. Address - separates the tester channels by pin type. The user must select a tab to view that pin type.

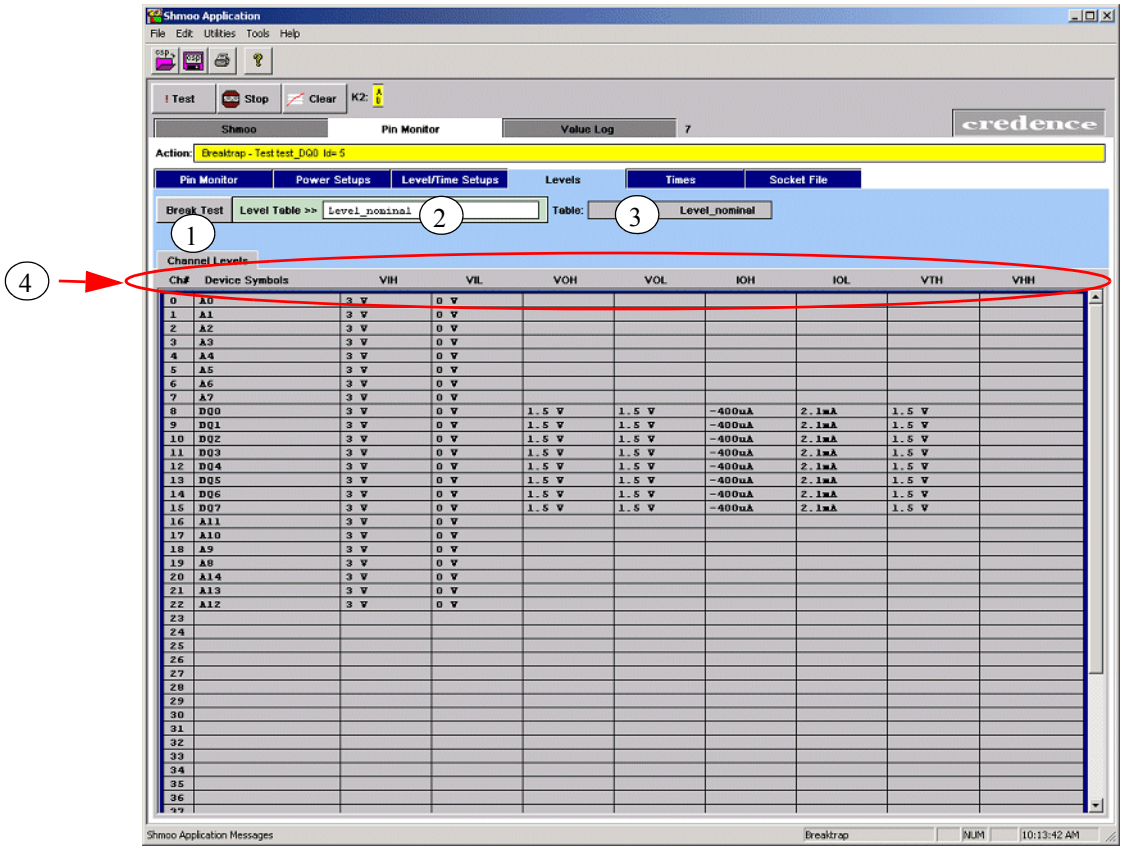
6. Address Channel - select a single pin of the selected pin type to modify the shmoo setups for that pin.
7. Name/Resource - once a Level Table and EdgeSet are selected, this area shows the resources defined for the selected pin.
8. Programmed - shows the value programmed in the test program for the respective resource.
9. Start Value - shows the Starting value the shmoo starts at, determined by the index and number of steps with the programmed value at the midpoint.
10. Stop Value - shows the Stopping value the shmoo stops at, determined by the index and number of steps with the programmed value at the midpoint.
11. *Index - Shmoo generated setup is based on the default Index value; however, the user may change the value by selecting one of the predefined values in this field.
12. *Steps - Shmoo generated setup is based on the default Steps value; however, the user may change the value by selecting one of the predefined values in this field.
13. Reset button - returns the Index and Steps field tables to the default values.

NOTE — * Index and steps can be changed.

Levels Window

The Levels window provides a view only window that displays the levels set in any Level Table contained in the KTL program. The user may select a Level Table for viewing, or allow the application to automatically select the Level Table used by the test on which the breaktrap is set. See Figure 280 for the layout of the Levels window.

Figure 280. Levels Window



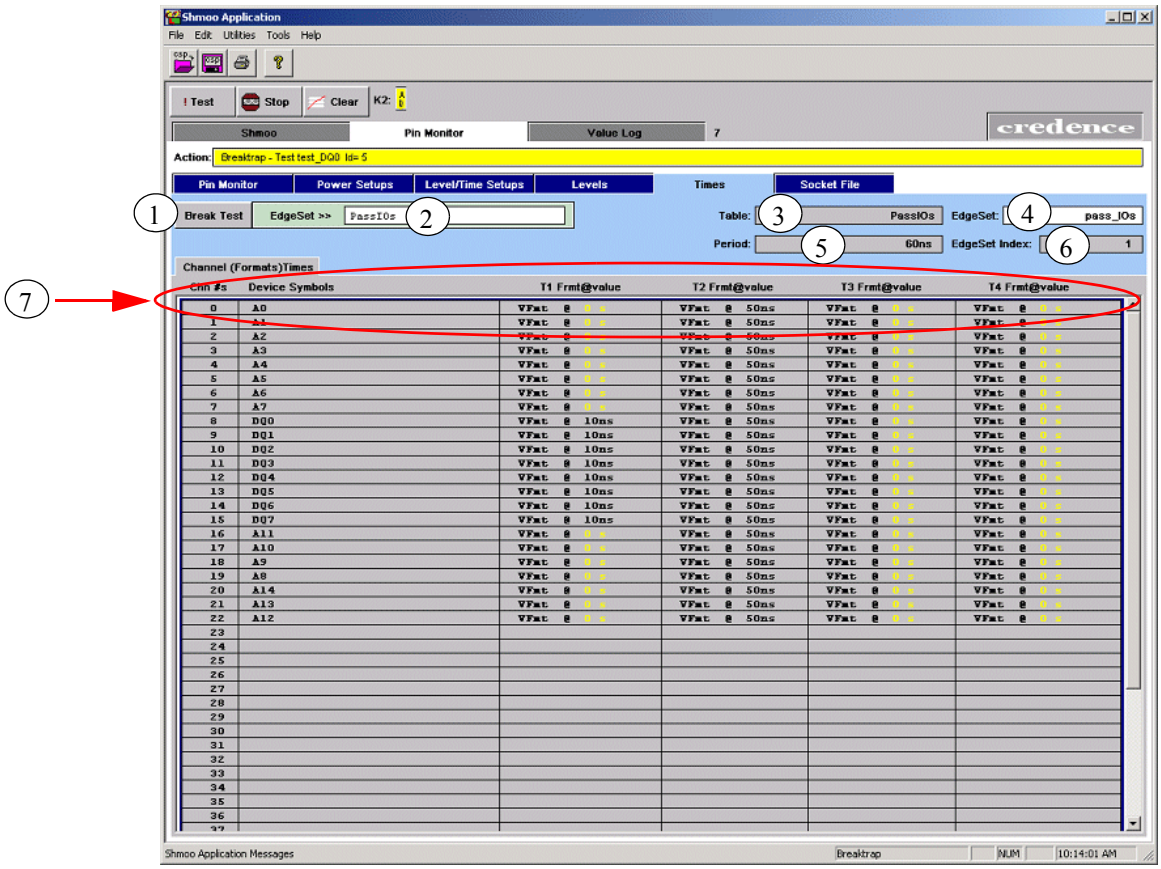
Following is the description of each field of the Levels window:

1. Break Test button - switches between Break Test and Level Table. When Break Test is selected, Pin Monitor retrieves the KTL programmed Level Table from the test program. If Level Table is selected, manually select the Level Table.
2. BreakTest/Level Table - when Break Test is selected, this window acts as read only and displays the Level Table retrieved from the test program. If Level Table is selected, a drop-down menu appears. Use this drop-down menu to select the Level Table used by the breaktrap.
3. Table - shows the currently selected Level Table.
4. Channel Levels - shows each tester channel with its pin name and the programmed value of each resource.

Times Window

The Times tab displays a window that is similar to the **Levels** window. It allows the user to select an EdgeSet and view the timing and format information for that edgeset. Also, this application feature can automatically select the edgeset used by the test on which the breaktrap is set (see Figure 281).

Figure 281. Times Window



Following is the description of each field of the **Times** window:

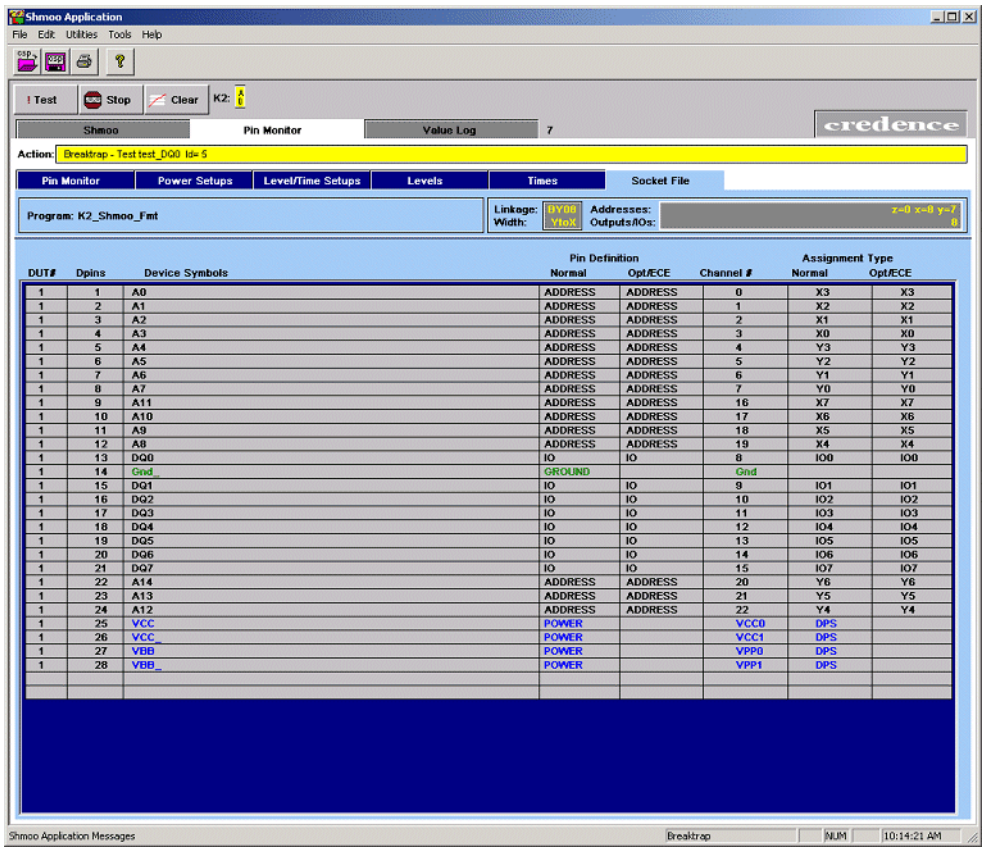
1. Break Test - switches between Break Test and EdgeSet. When Break Test is selected, Pin Monitor retrieves the KTL programmed EdgeSet from the test program. If EdgeSet is selected, manually select the EdgeSet.
2. Break Test/Level Table - when Break Test is selected, this window acts as read only and displays the EdgeSet retrieved from the test program. If EdgeSet is selected, a drop-down menu appears. Use this drop-down menu to select the EdgeSet used by the breaktrap.
3. Table - shows the currently selected EdgeSet.

4. EdgeSet - selects the EdgeSet number from the option list on which the breaktrap is set.
5. Period - shows the Period value used by the selected edgeset.
6. EdgeSet Index - shows the edgeset number used by the selected edgeset.
7. Channel (Formats) Times - shows each tester channel with its pin name and the programmed value of each resource.

Socket Window

The **Socket** window provides a view only display of the automatically inherited socket file from the test program loaded in Front Panel. This display allows the user to observe the DUT pin to tester channel assignments of the test program. Information concerning address steering and data bus width is also provided. See Figure 282 for the layout of the Socket window.

Figure 282. Socket Window


Shmoo Application
File Edit Utilities Tools Help
! Test
Stop
Clear
K2:
Shmoo
Pin Monitor
Value Log
7
credence
Action: Breaktrap - Test test_DQ0 Id= 5
Pin Monitor
Power Setups
Level/Time Setups
Levels
Times
Socket File
Program: K2_Shmoo_Fmt
Linkage:
Width:
Addresses:
Outputs/IOs:
Pin Definition
Assignment Type
DUT# Dpins Device Symbols Normal Opt/ECE Channel # Normal Opt/ECE
1 1 A0 ADDRESS ADDRESS 0 X3 X3
1 2 A1 ADDRESS ADDRESS 1 X2 X2
1 3 A2 ADDRESS ADDRESS 2 X1 X1
1 4 A3 ADDRESS ADDRESS 3 X0 X0
1 5 A4 ADDRESS ADDRESS 4 Y3 Y3
1 6 A5 ADDRESS ADDRESS 5 Y2 Y2
1 7 A6 ADDRESS ADDRESS 6 Y1 Y1
1 8 A7 ADDRESS ADDRESS 7 Y0 Y0
1 9 A11 ADDRESS ADDRESS 16 X7 X7
1 10 A10 ADDRESS ADDRESS 17 X6 X6
1 11 A9 ADDRESS ADDRESS 18 X5 X5
1 12 A8 ADDRESS ADDRESS 19 X4 X4
1 13 DQ0 IO IO 8 IO0 IO0
1 14 Gnd_ GROUND Gnd
1 15 DQ1 IO IO 9 IO1 IO1
1 16 DQ2 IO IO 10 IO2 IO2
1 17 DQ3 IO IO 11 IO3 IO3
1 18 DQ4 IO IO 12 IO4 IO4
1 19 DQ5 IO IO 13 IO5 IO5
1 20 DQ6 IO IO 14 IO6 IO6
1 21 DQ7 IO IO 15 IO7 IO7
1 22 A14 ADDRESS ADDRESS 20 Y6 Y6
1 23 A13 ADDRESS ADDRESS 21 Y5 Y5
1 24 A12 ADDRESS ADDRESS 22 Y4 Y4
1 25 VCC POWER VCC0 DPS
1 26 VCC_ POWER VCC1 DPS
1 27 VBB POWER VPP0 DPS
1 28 VBB_ POWER VPP1 DPS
Shmoo Application Messages
Breaktrap
NUM
10:14:21 AM

Explicitly Defined Versus Inherited Resources

Resources such as the Level Table, EdgeSet, and DPSSET may be retrieved by explicitly defining them within the test block or they can be inherited from a previous test block. Read_test explicitly defines these resources within the test block as follows:

```
TEST Read_test = {
                              TESTNO = 1;
       DESC = "Standard Read Test";
  SEQUENCE = {
    normal_dps, // Explicitly defined DPSSET
    read_levels, // Explicitly defined Level Table
    edgeSet1, // Explicitly defined EdgeSet
    read__pat,
    PG_RUN
    };
   };
```

Resources are inherited from a previous test block if a test which explicitly defined a resource is run, followed by a test which does not explicitly define that resource. When this occurs, the current test inherits the resource from the previous test. For example, if the Write_test is executed before running the Read_test, the Read_test inherits the DPSSET, Level Table, and EdgeSet from the Write_test.

```
TEST Write_test = {
  TESTNO = 1;
  DESC = "Standard Write Test";
  SEQUENCE = {
    normal_dps, // Explicitly defined DPSSET
    read_levels, // Explicitly defined Level Table
    edgeSet1, // Explicitly defined EdgeSet
    write_pat,
    PG_RUN
    };
   };


TEST Read_test = {
  TESTNO = 1;
  DESC = "Standard Read Test";
  SEQUENCE = {
    read__pat,
    PG_RUN
    };
   };
```

This difference affects the way a user can configure the Pin Monitor application. If a resource is explicitly defined in a test block, the user can select the *Break Test* button to obtain the resource from the test program. However, if the resource is inherited from a previous test block, then the user must manually select the resource from the drop-down list in Pin Monitor window.

Examples

The following examples provide shmoo test procedures using the Pin Monitor application.

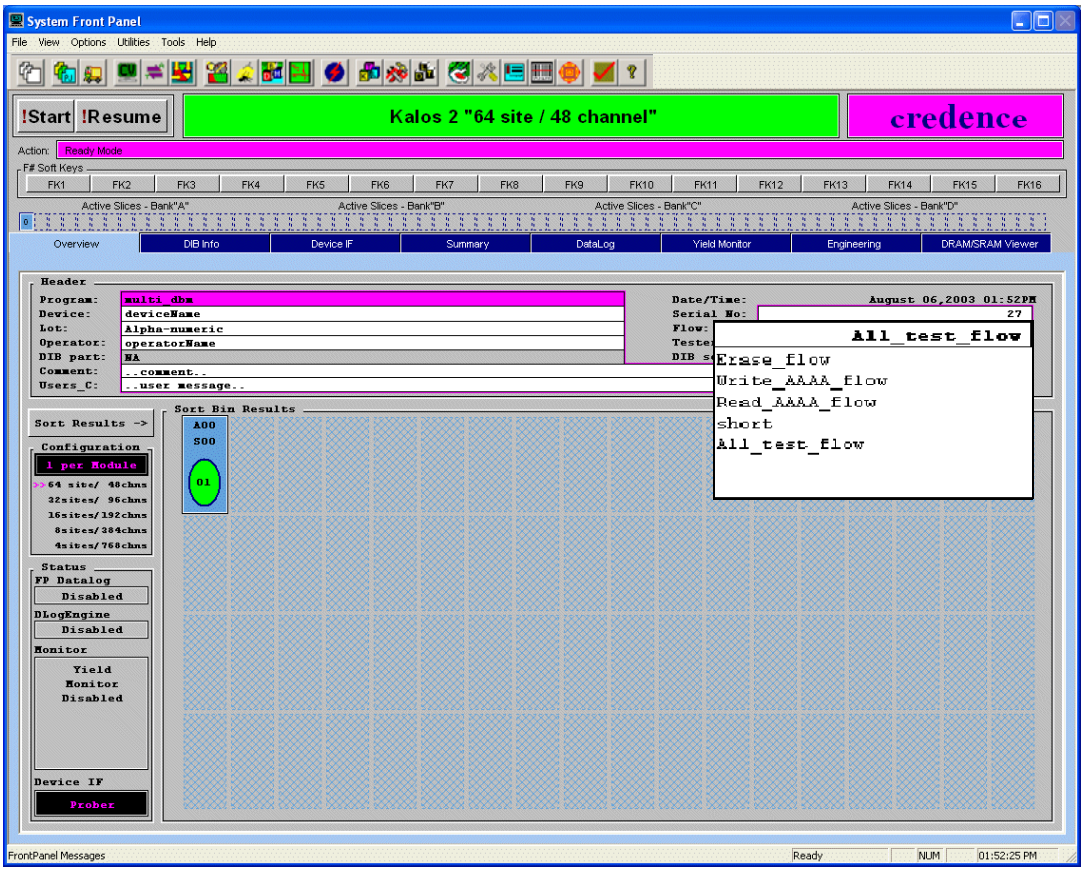
Example 1 - Setting up and Running a Test on T1 of an I/O

This example explains the procedure to run a shmoo on the T1 resource of an I/O channel. This procedure includes setting a breaktrap in Front Panel, configuring Pin Monitor, and setting up the shmoo parameters. This example also covers the different testing options available on the Pin Monitor application.

Use the following procedure to run the Shmoo tool.

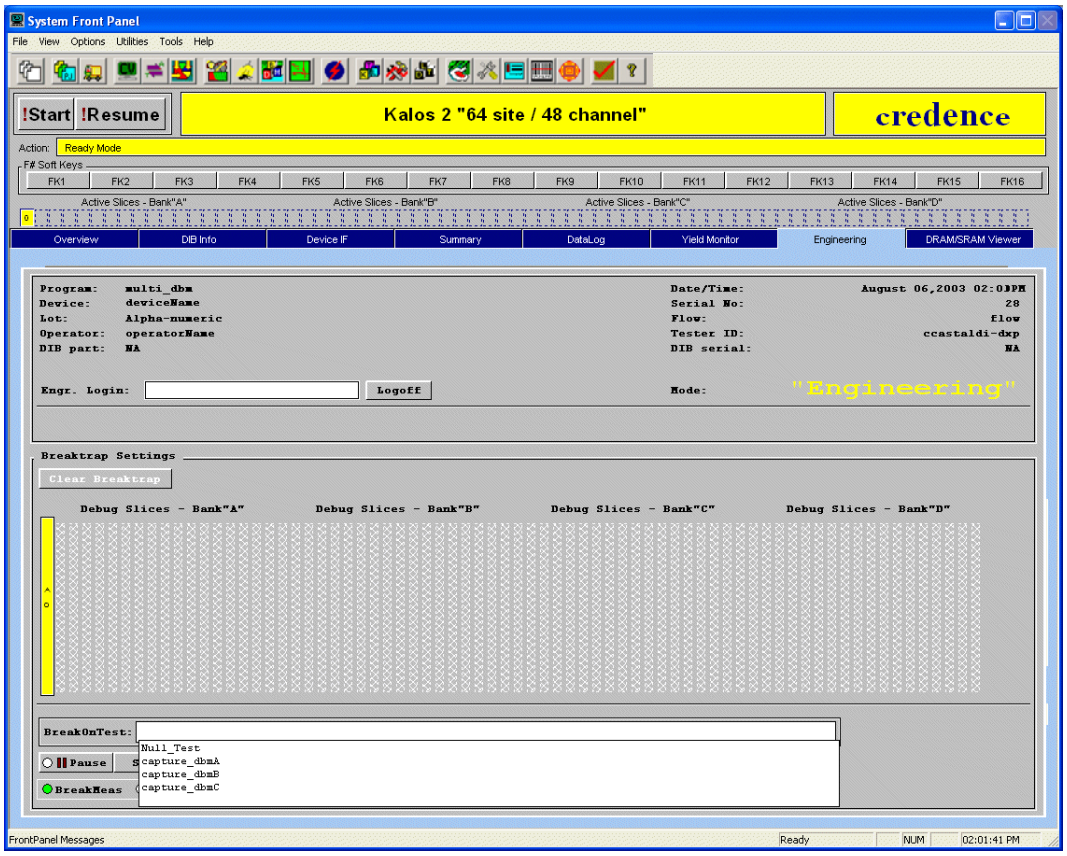
1. Prepare the device and load the test program in the Front Panel.
2. Select the flow type of the test program by choosing one of the options from the drop-down menu list of the Flow options (see Figure 283). Note that this option requires two or more available test flows.

Figure 283. Select Flow



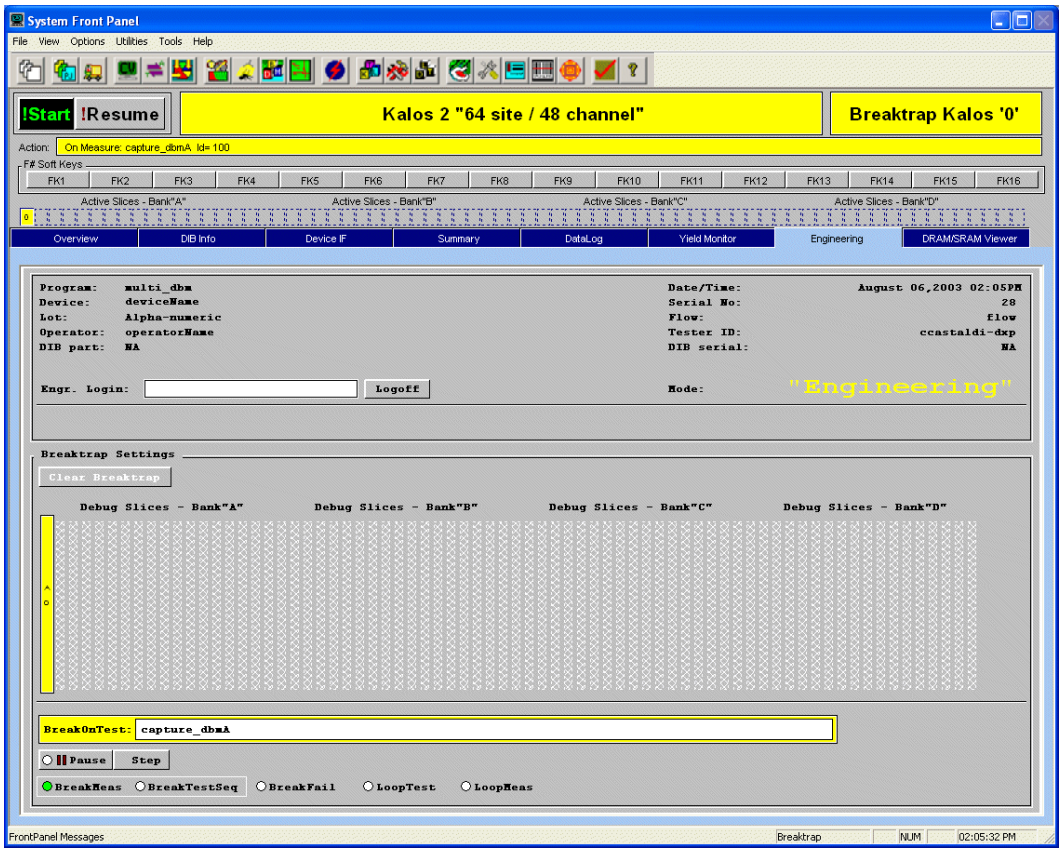
3. Select the Engineering tab from Front Panel and enter the password.
4. Click the BreakMeas button and select the test on which the breaktrap is set (see Figure 284).

Figure 284. Set Breaktrap



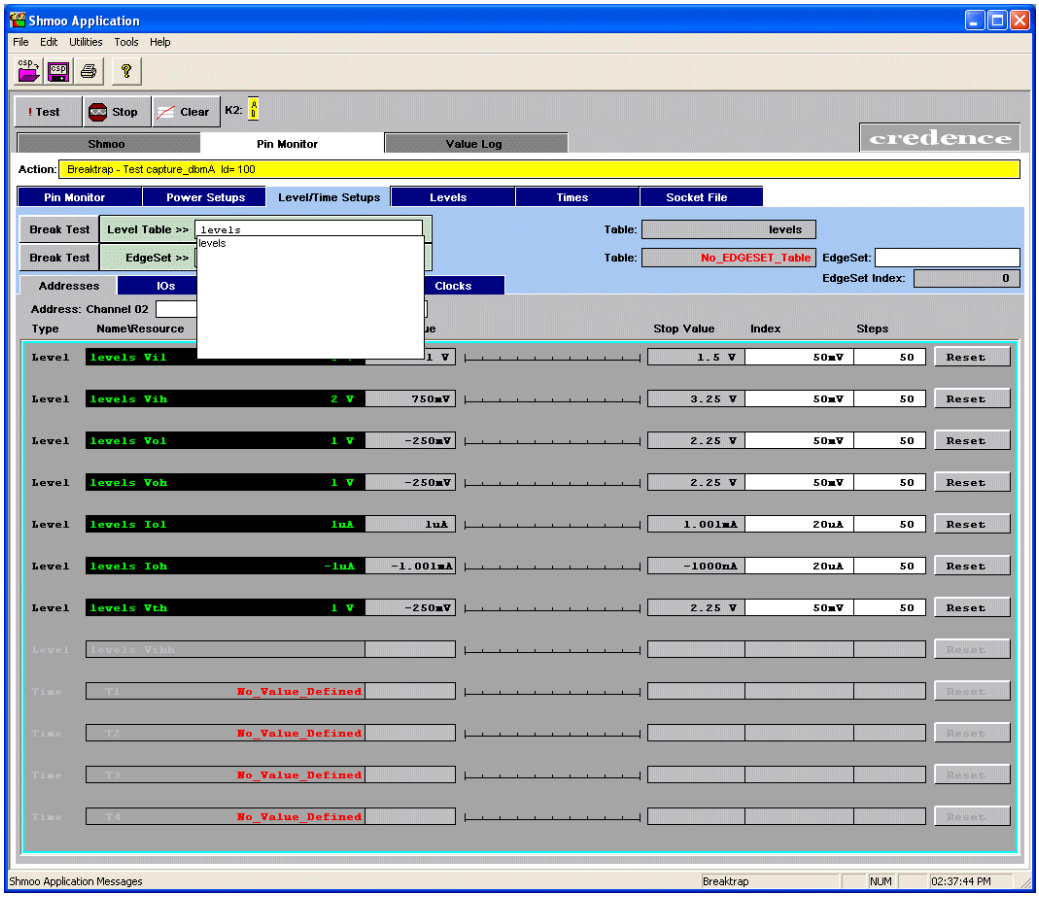
5. Click the Start button of Front Panel to initiate the breaktrap (see Figure 285).

Figure 285. Front Panel with Breaktrap Set


System Front Panel
File View Options Utilities Tools Help
!Start !Resume
Kalos 2 "64 site / 48 channel"
Breaktrap Kalos '0'
Action: On Measure: capture_dbmA Id= 100
F# Soft Keys
FK1 FK2 FK3 FK4 FK5 FK6 FK7 FK8 FK9 FK10 FK11 FK12 FK13 FK14 FK15 FK16
Active Slices - Bank"A" Active Slices - Bank"B" Active Slices - Bank"C" Active Slices - Bank"D"
Overview DIB Info Device IF Summary DataLog Yield Monitor Engineering DRAM/SRAM Viewer
Program: multi_dbm
Device: deviceName
Lot: Alpha-numeric
Operator: operatorName
DIB part: NA
Date/Time: August 06,2003 02:05PM
Serial No: 28
Flow: flow
Tester ID: ccastaldi-dxp
DIB serial: NA
Engr. Login:
Logoff
Mode: "Engineering"
Breaktrap Settings
Clear Breaktrap
Debug Slices - Bank"A" Debug Slices - Bank"B" Debug Slices - Bank"C" Debug Slices - Bank"D"
BreakOnTest: capture_dbmA
Pause Step
BreakMeas BreakTestSeq BreakFail LoopTest LoopMeas
FrontPanel Messages
Breaktrap
NUM
02:05:32 PM

6. Click the Pin Monitor button on Front Panel to start the Pin Monitor application.
7. Click on the Level/Time Setups tab.
8. Select a Level Table either by clicking on the Break Test button (see Figure 287) or by manually selecting the Level Table (see Figure 286) used by the test on which the breaktrap is set.

Figure 286. Manually Selecting Level Table



9. Select an EdgeSet either by clicking on the Break Test button (see Figure 287) or by manually selecting the EdgeSet (see Figure 288) used by the test on which the breaktrap is set.

Figure 287. Using the Break Test Button.

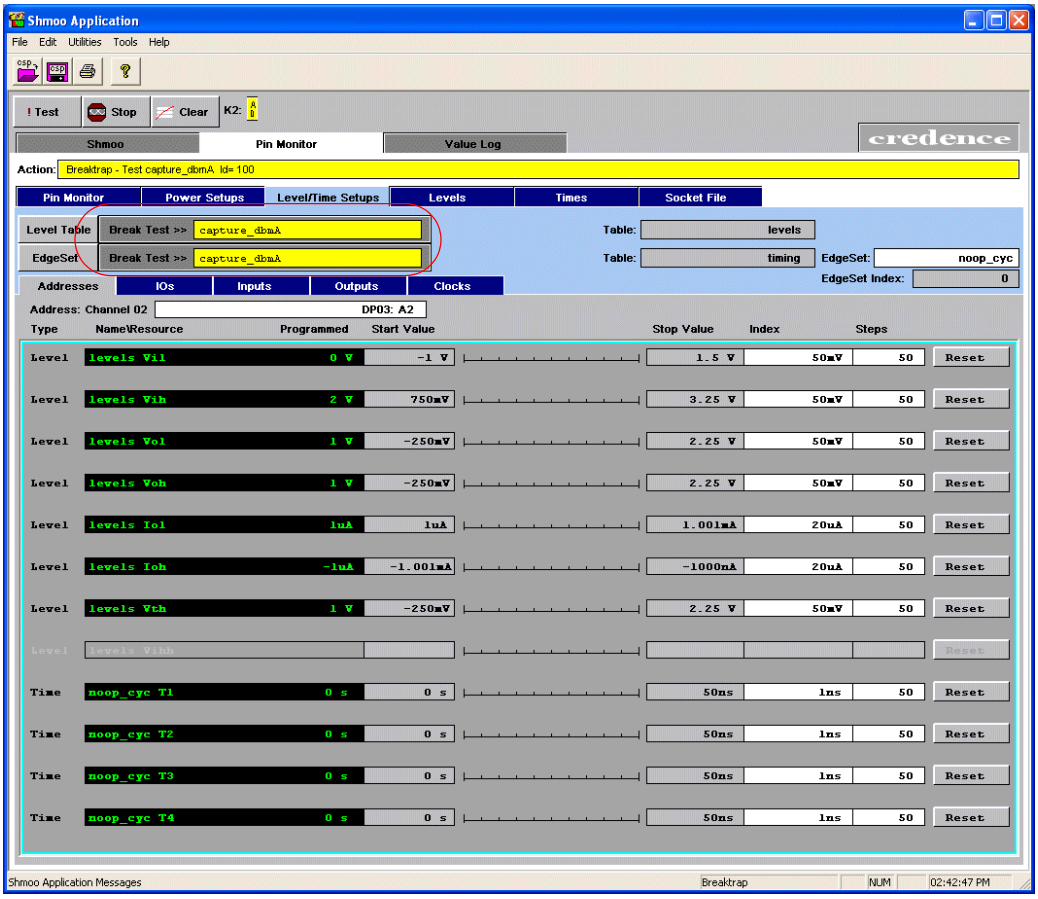
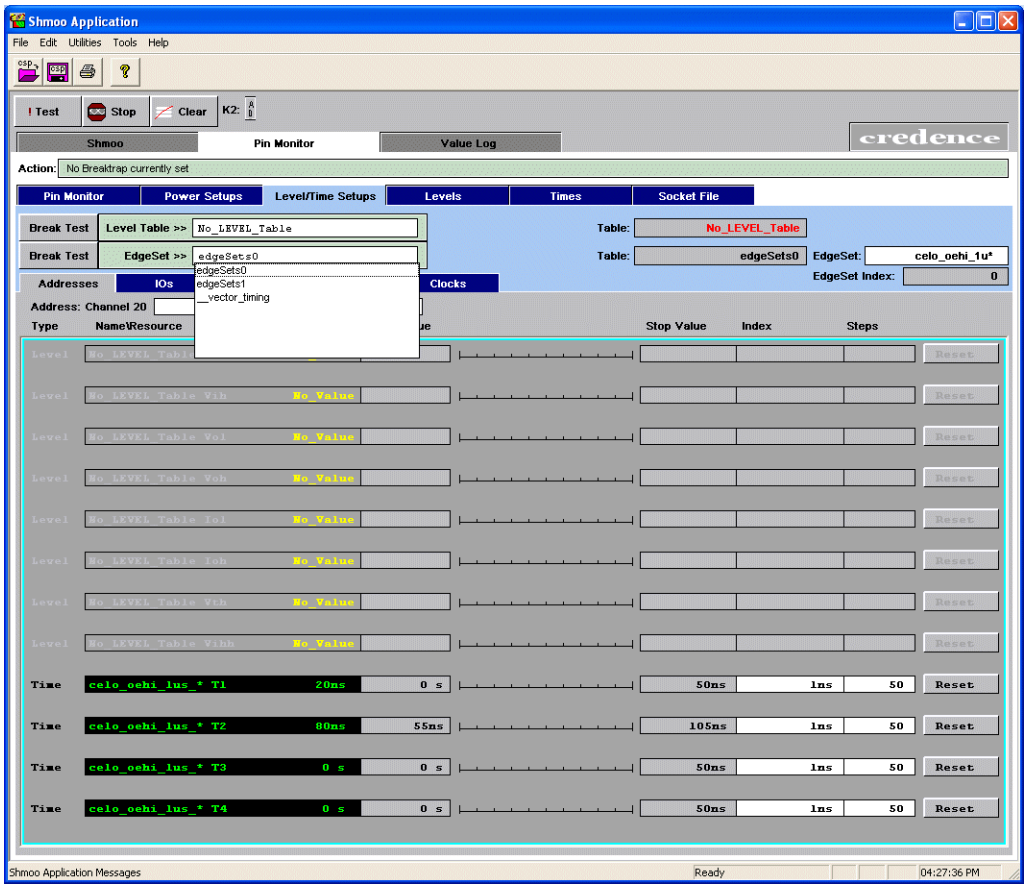
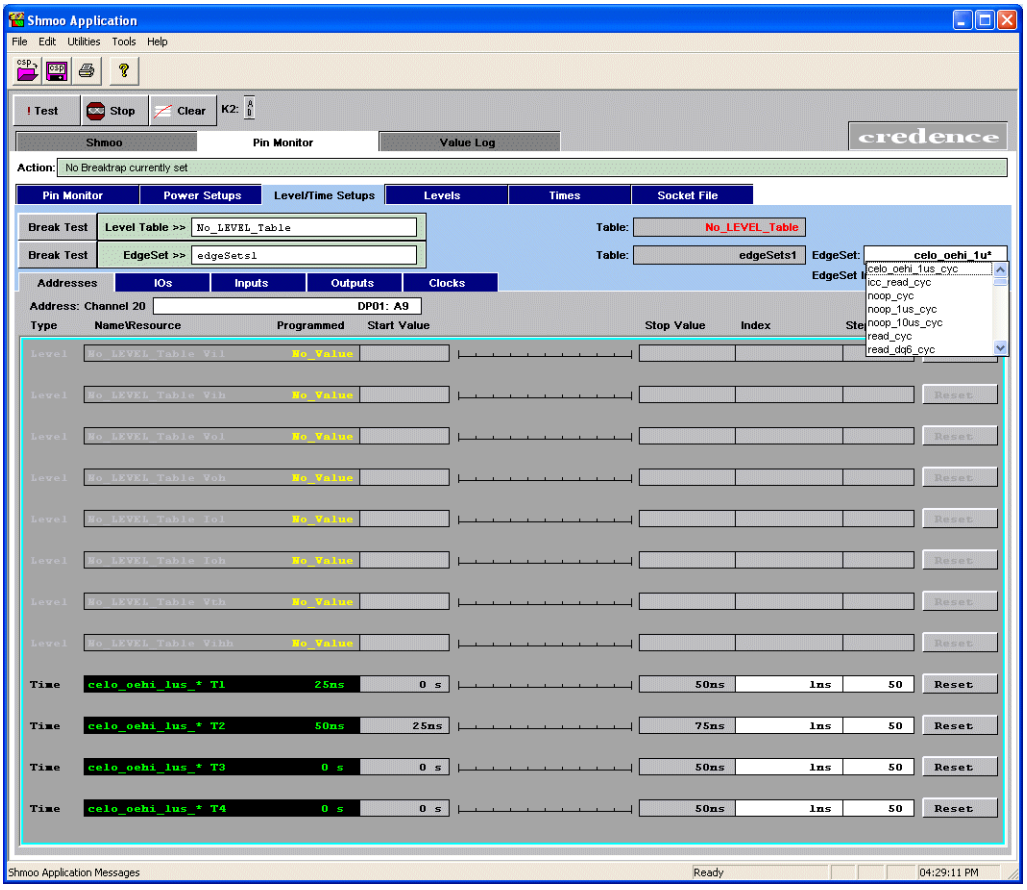

Shmoo Application
File Edit Utilities Tools Help
! Test
Stop
Clear
K2:
Shmoo
Pin Monitor
Value Log
credence
Action: Breaktrap - Test capture_dbmA Id= 100
Pin Monitor
Power Setups
Level/Time Setups
Levels
Times
Socket File
Level Table
Break Test >>
capture_dbmA
EdgeSet
Break Test >>
capture_dbmA
Table: levels
Table: timing
EdgeSet: noop_cyc
EdgeSet Index: 0
Addresses
IOs
Inputs
Outputs
Clocks
Address: Channel 02
DP03: A2
Type Name\Resource Programmed Start Value Stop Value Index Steps
Level levels Vil 0 V -1 V 1.5 V 50mV 50 Reset
Level levels Vih 2 V 750mV 3.25 V 50mV 50 Reset
Level levels Vol 1 V -250mV 2.25 V 50mV 50 Reset
Level levels Voh 1 V -250mV 2.25 V 50mV 50 Reset
Level levels Iol 1uA 1uA 1.001mA 20uA 50 Reset
Level levels Ioh -1uA -1.001mA -1000nA 20uA 50 Reset
Level levels Vth 1 V -250mV 2.25 V 50mV 50 Reset
Level levels Vihh Reset
Time noop_cyc T1 0 s 0 s 50ns 1ns 50 Reset
Time noop_cyc T2 0 s 0 s 50ns 1ns 50 Reset
Time noop_cyc T3 0 s 0 s 50ns 1ns 50 Reset
Time noop_cyc T4 0 s 0 s 50ns 1ns 50 Reset
Shmoo Application Messages
Breaktrap
NUM
02:42:47 PM

Figure 288. Manually Selecting the EdgeSet



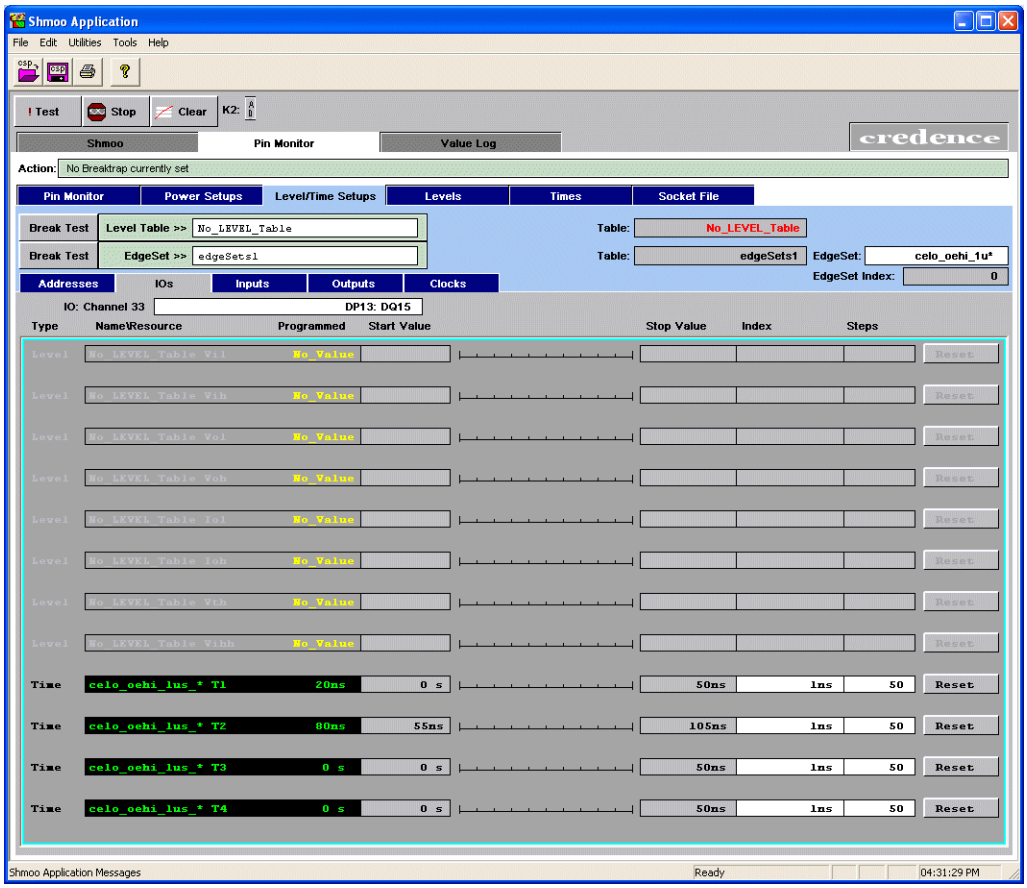
10. Select the edgeset that the breaktrap is set on (see Figure 289).

Figure 289. Selecting an EdgeSet



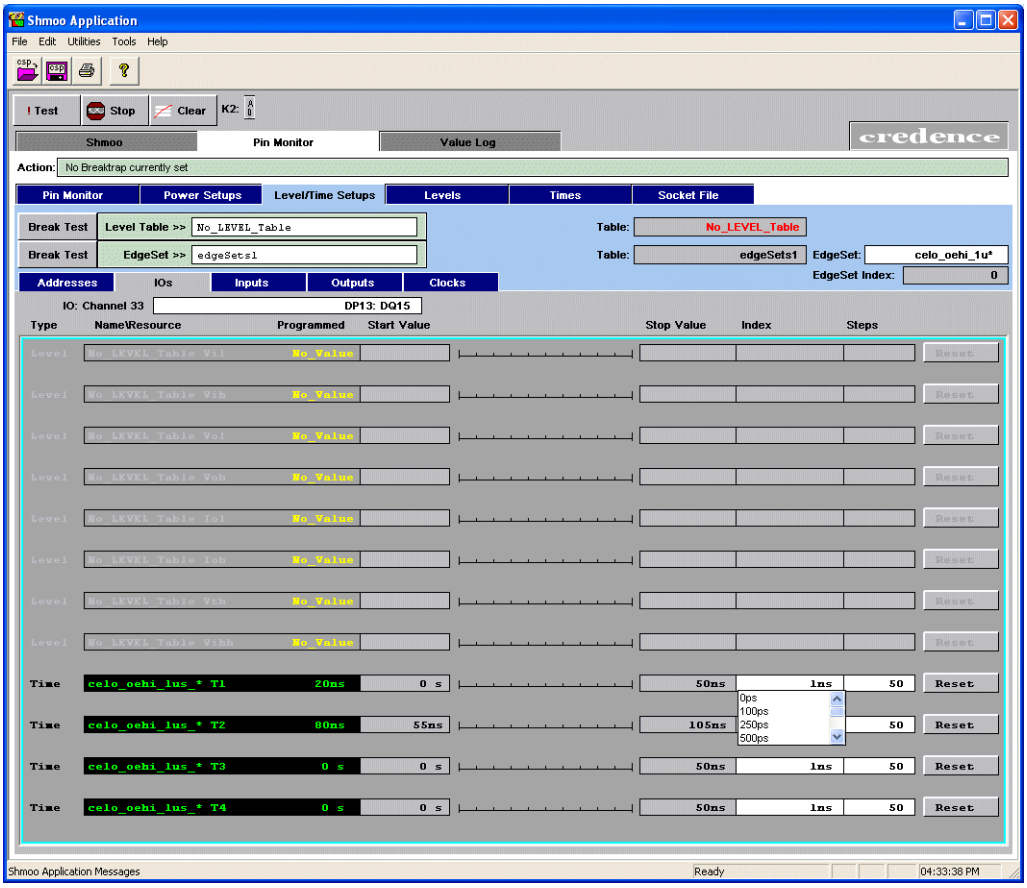
11. Click on the IOs subtab of the Level/Time Setups tab (see Figure 290).

Figure 290. IOs Subtab



12. Adjust the Index and Step values for the shmoo. Adjusting these values changes the shmoo setups for all channels (see Figure 291).

Figure 291. Adjust Index.



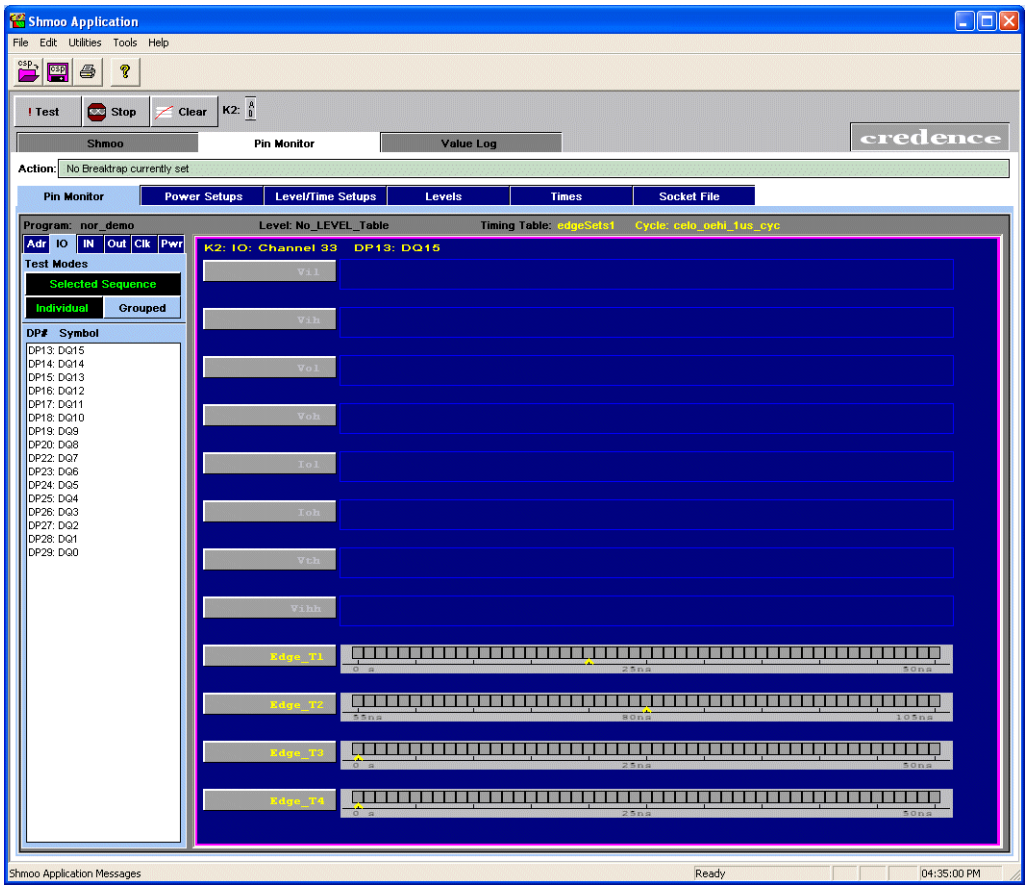
13. Click the Pin Monitor tab.
14. Click the IO subtab of the Pin Monitor tab.
15. Select the IO channel to perform the test on.
16. Click the T1 button to run the shmoo of the T1 resource only. To run Pin Monitor test for all resources one at a time, click the Test button.

NOTE — Since Selected Sequence and Individual are the defaults, the test is run on the single pin that is selected.

17. Click the Selected Sequence button to go to Auto Sequence mode, then click the T1 button again (see Figure 292).

NOTE — In Auto Sequence mode, shmoo runs on each channel, one at a time. The user can view the results of each shmoo by selecting the desired channel.

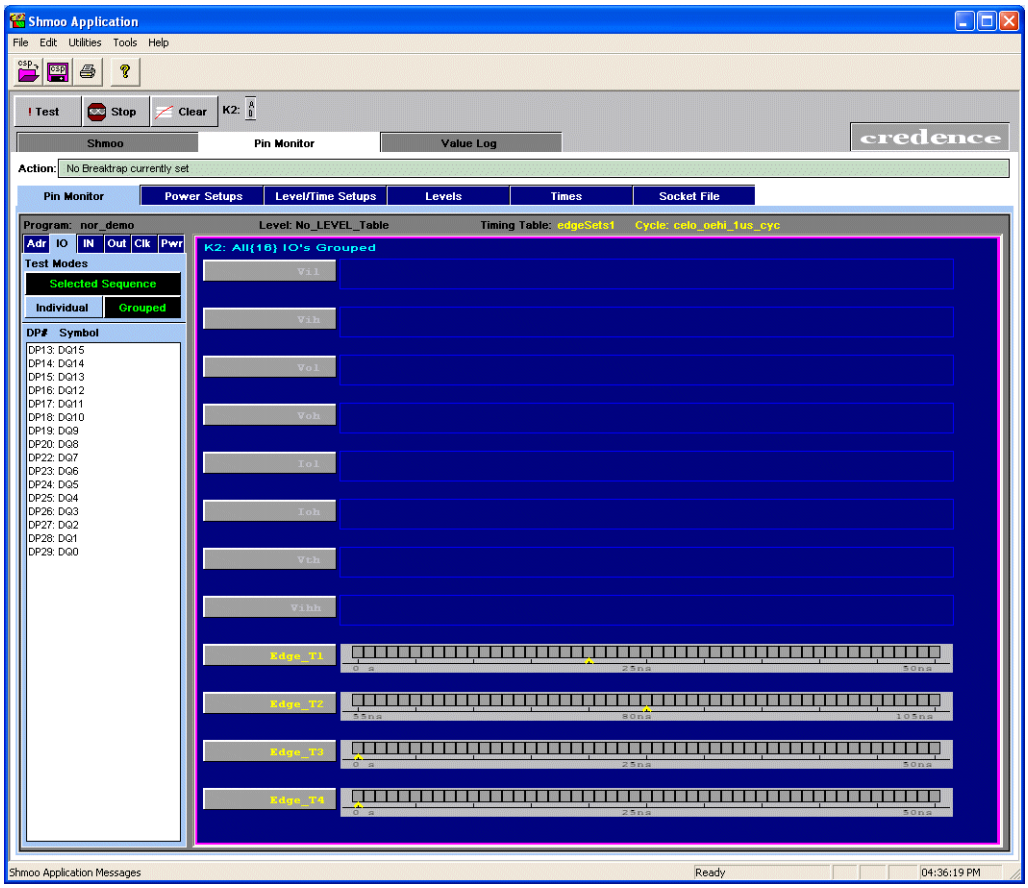
Figure 292. Auto Sequence Test



18. First click the Grouped Button then click the T1 button again (see Figure 293).

NOTE — Clicking on the Grouped button automatically changes Pin Monitor to Selected Sequence mode and gives one final result as all of the channels are treated as one group. This result is visible only if the selected channel remains the same after the test is run.

Figure 293. Grouped Testing



Example 2 - Characterization of Power Supplies

This example shows how to setup and run shmoo testing of a power supply using the Pin Monitor application. Using Pin Monitor to initiate shmoo testing of a power supply is very similar to that of a channel. The following steps are used to setup and run the shmoo testing using Pin Monitor:

1. Set a breaktrap as shown in Example 1.
2. Initiate the Pin Monitor application.
3. Click the Power Setups tab.
4. Select a DPSSET either by clicking the Break Test button (see Figure 294) or by manually selecting the DPSSET used by the test on which the breaktrap is set (see Figure 295).

Figure 294. Setting DPSSET Using the Break Test Button

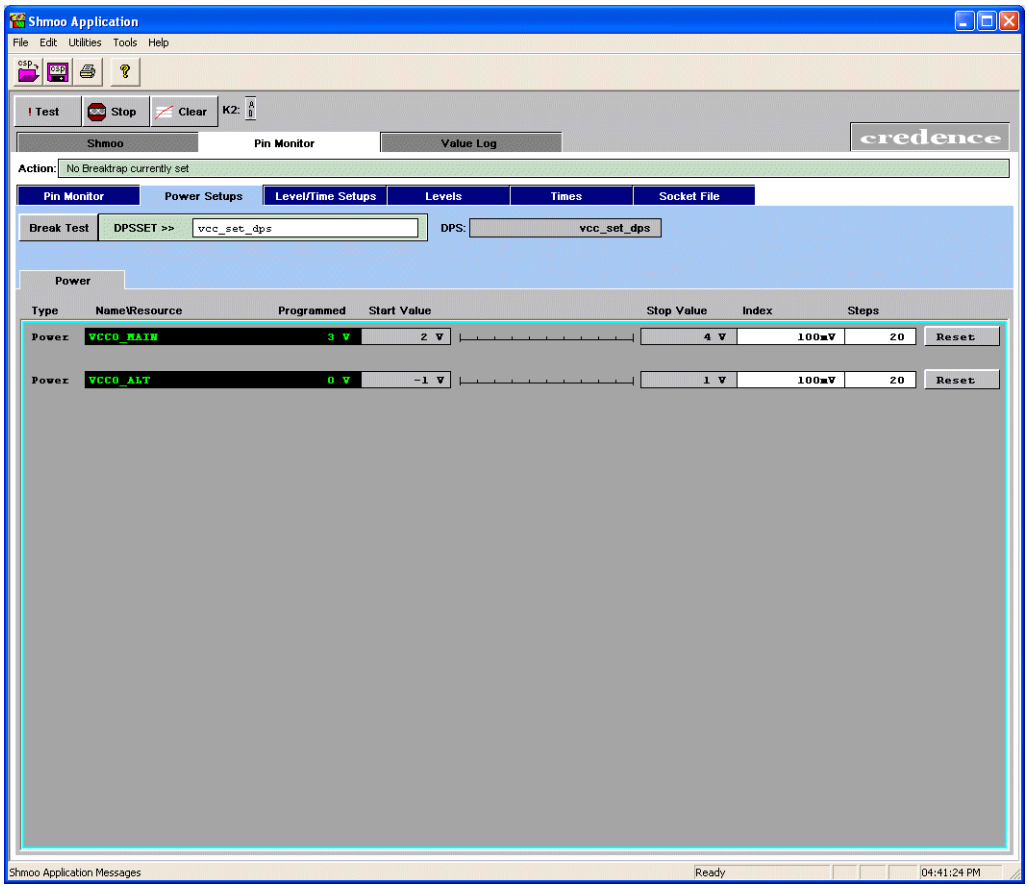
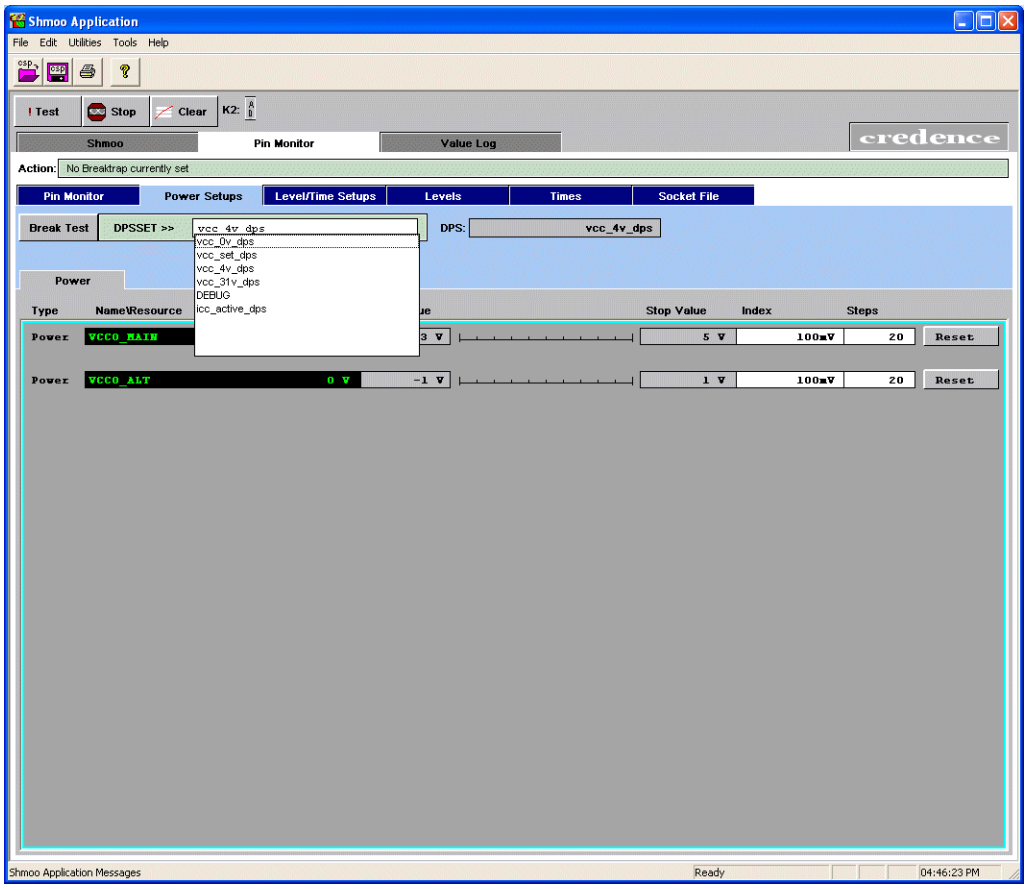


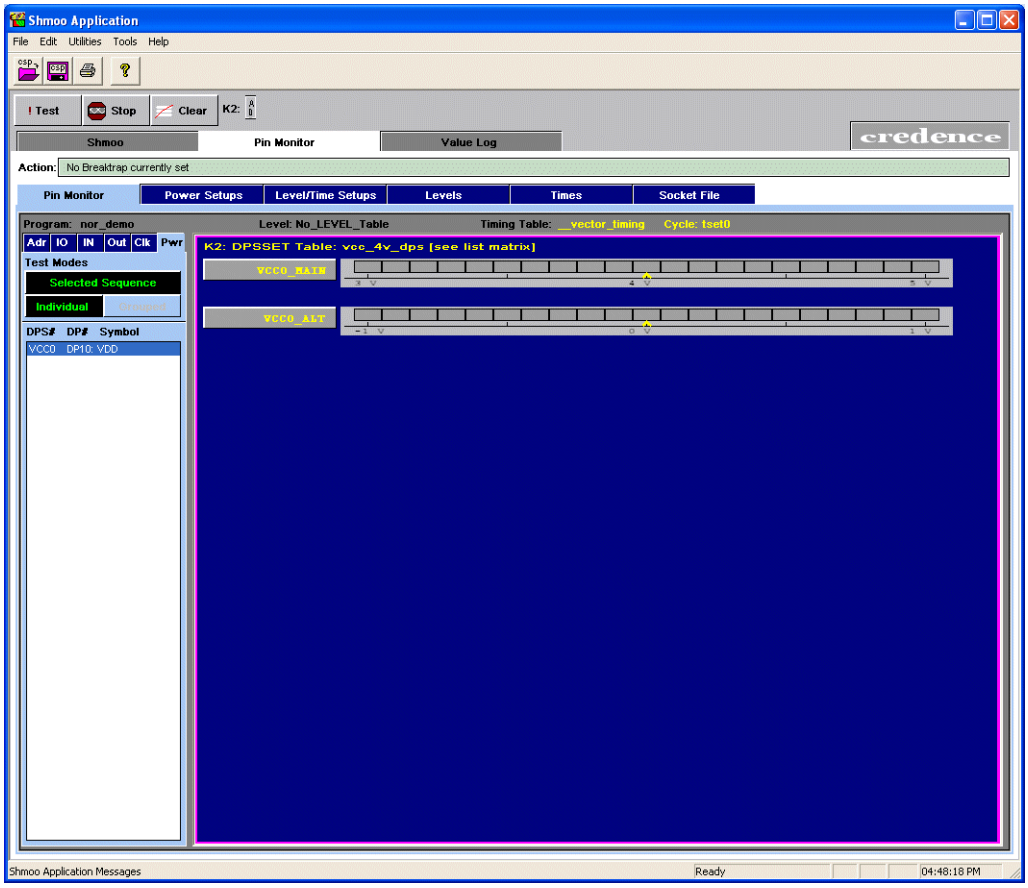
Figure 295. Manually Selecting a DPSSET



5. Adjust the Index and Step values for the shmoo. Adjusting these values changes the shmoo setups for all channels (see Figure 291).
6. Click the Pin Monitor tab.
7. Click the Pwr subtab of the Pin Monitor viewer.
8. Select a power supply on which to perform the test.
9. Click the PS1M button to run the shmoo of the main resource only. To test all resources one at a time, click the Test button (see Figure 296).

NOTE — Power supplies may not be tested in Grouped mode.

Figure 296. Power Supply Shmoo Results



Value Log

The Value Log application provides an AC Datalogger that is available on Kalos 2 test systems. Two types of test execution are available to users: a binary (search) or a linear (sweep) test. Parametric, PMU and/or PPMU, type of testing is not supported under this release. The result is determined by the selected Setup, and is the pass point at the detected fail/pass region.

Define single test (selected row) or multiple testing (all rows). The start and stop test execution is determined by the pulldown, Start Test:, menu on the Value Log property page (see Figure 297).

The Socket Table property page (see Figure 298) allows the user to select *Get Online* or *Interactive Socket Table*. If the *Online Socket Table* is being used, the device program controls the Value Log configurations, whereas the *Interactive Socket Table* allows the user to override any of the Value Log configurations.

NOTE — The *Online Socket Table* cannot be modified directly, but it can be transferred to the *Interactive Socket Table* where generation, deletion, and/or modification can occur.

The Value Log test variables setups (see Figure 298) are the same as defined by the Kalos 2 Shmoo and Bitmap tools. This allows the setups to be interchangeable between the tools.

Figure 297. Value Log Property Pages

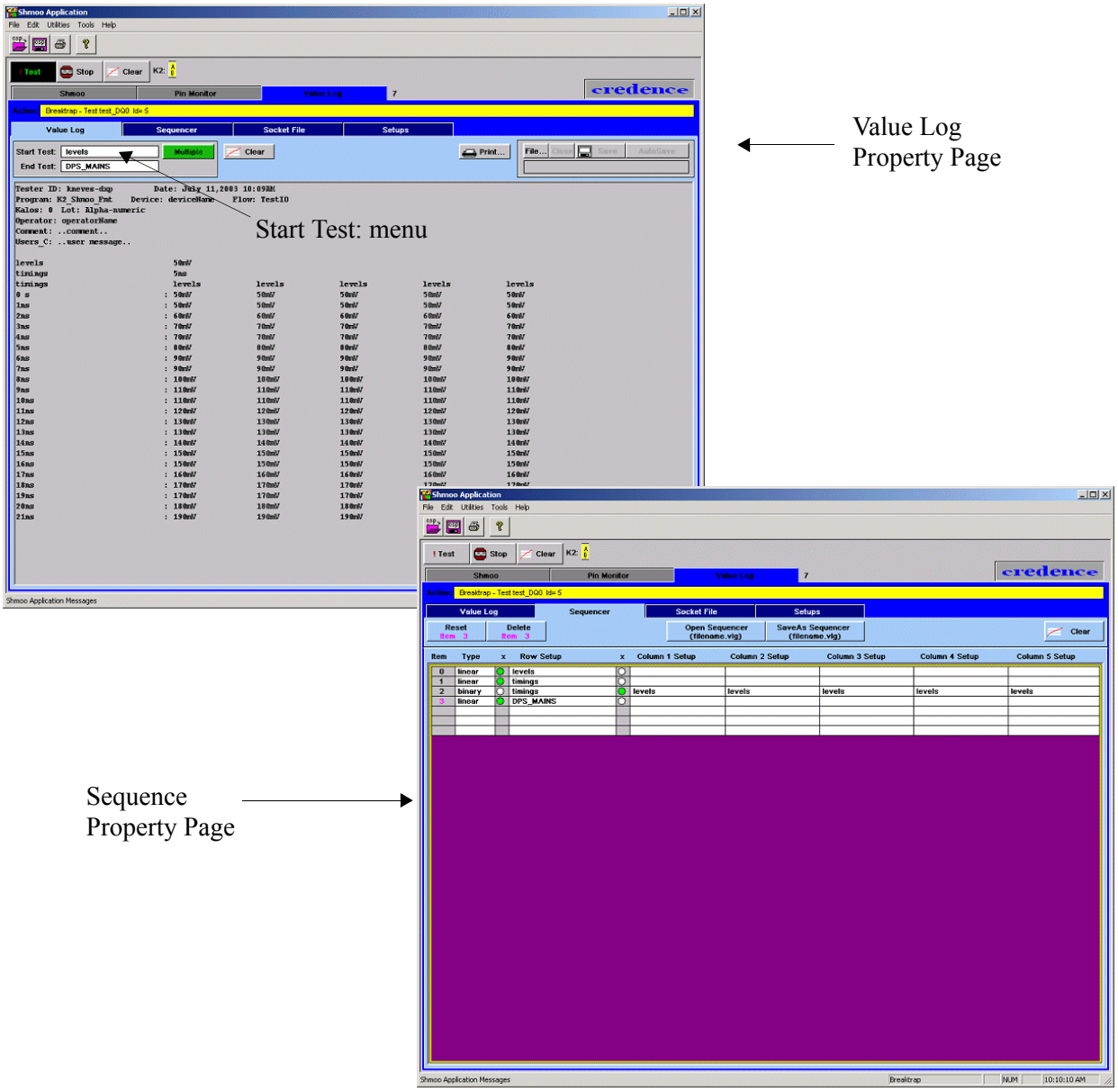
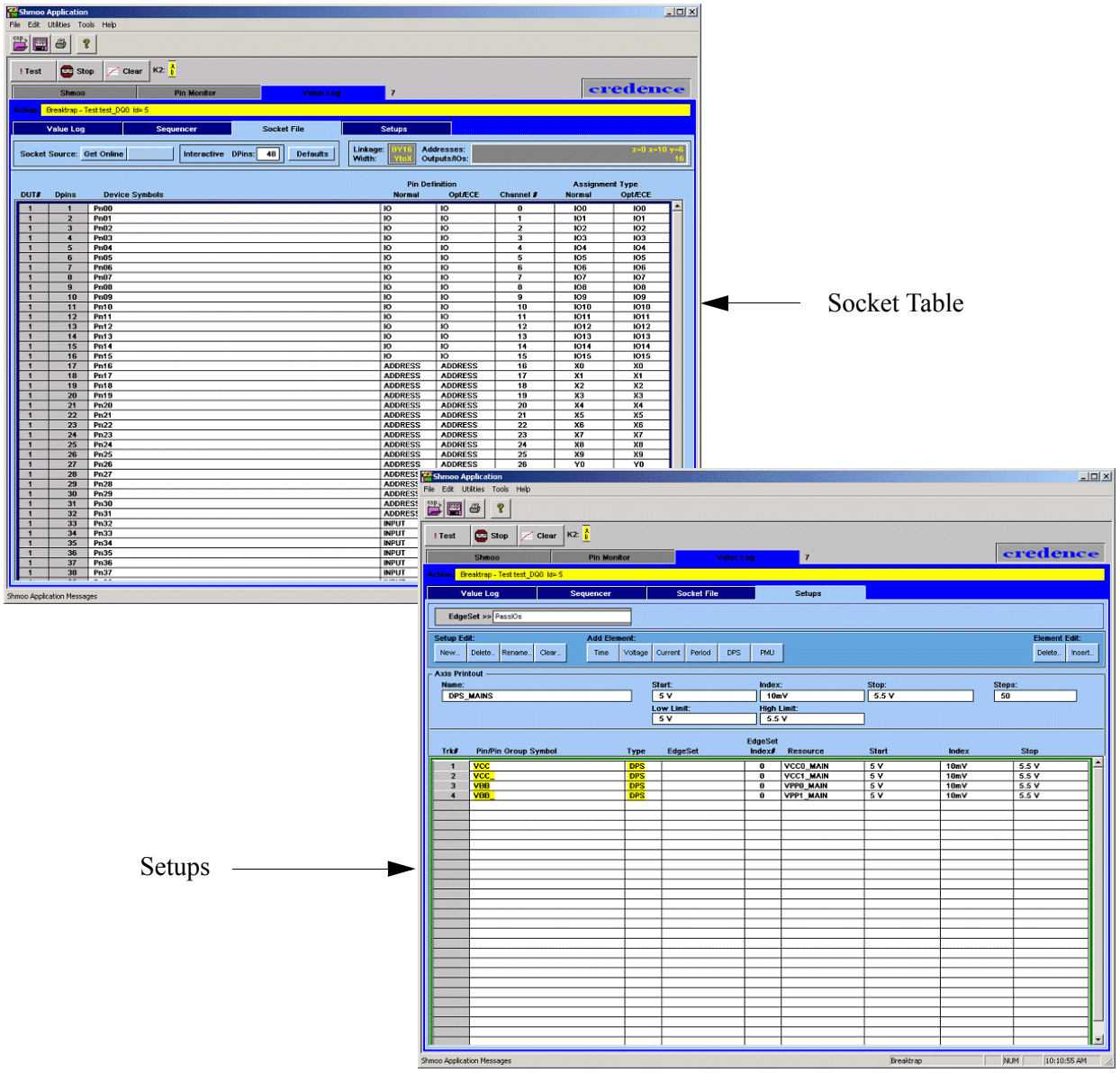


Figure 298. Value Log Socket Table and Setups



Bitmap

The Bitmap tool has multiple operational modes available on Kalos 2 tester systems. These operations include online (data gathered using Kalos 2 Memory Tester) and offline (*.bfm files, saved during online/offline operations) interactions.

The Bitmap viewer displays current (online) cell/address failures of the device under test. This includes two screen displays: Bitmap and MegaMap. The MegaMap is a compressed view of the total DUT's bit array, whereas the Bitmap is a selected encompassed block of the MegaMap. Maximum size of the MegaMap is 256 x 256 compression:

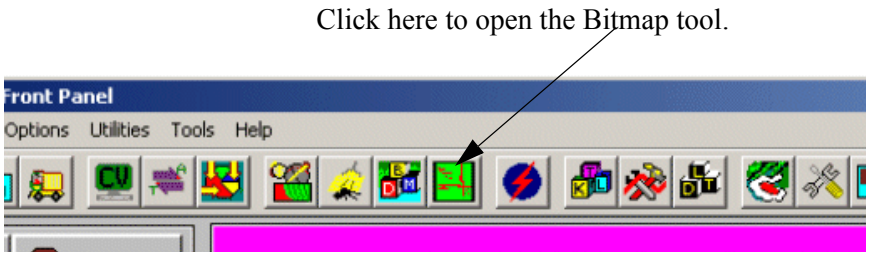
288 M-bit SRAM (1 SRAM), 576 x M-bits (2 SRAMs tied together)

with the Bitmap having a maximum of a 1024 x 1024 (1 Meg) display of any place on the MegaMap (Zoom dependent).

NOTE — If Zoom scale is:
1:1, the maximum cell representation is a 1M-bits.
16 : 16, the minimum cell representation is a 4 K-bits.

The Bitmap tool is launched by clicking on the Bitmap icon (see Figure 299) or it can be selected (launched) from the Tools menu item.

Figure 299. Bitmap Icon



Property Pages

The Bitmap tool property pages allow users to select which viewing operation to display. There are four selections available: Bitmap, Definitions (Display, Socket & Setups), Search Tables (Fail / User), and Overview & BIM Viewer. Property pages are selected by left mouse clicking on the desired property page tab.

Bitmap (sub-pages Bitmap, Editor, and Scan)
Includes the selection of the SRAM for ready display.

Definitions (Display, Socket & Setups)

Display — Online Socket file and Display Socket File.

Socket — Displays the currently configured socket table.

Setups — Set variable resource parameters for overriding the static conditions of the current test if the optional scanner operation is executed.

Search Tables (Fail / User)

Lists failures. Error by row or column preference to a text table.

Overviews & BIM Viewer

Overviews — Hardware block diagram, support matrix configuration of the Kalos 2 288 Mega-bit SRAM with address steering definitions for pointing to the requested ECR sequence start and stop addresses (from SRAM minimum to maximum), and selected display configuration.

.bim Viewer — Allows the user to load and view BIM file (either text table or bitmap display).

The primary windows (1 Mbit display see Figure 300, 256 Mbit see Figure 301) of the Bitmap are sub-divided into multiple view and/or control areas. These include the following, illustrated on Figure 300:

1. Menu Bar and Toolbar - Interface for selecting application operations.
2. Property Page (Tab) - Functional selection.
3. Breaktrap conditions - Controlled by way of the Front Panel.
4. Control Area - Specific control and mode selection.
5. Draw Area - Selected Bitmap View (max of 1024 x1024) with zooming.
6. Draw Area - MegaMap with compression, 288 M-bit SRAM (1 SRAM), 576 M-bits (2 SRAMs tied together).
7. Bitmap/Editor/Scan sub-page for the respective controls.
8. Application message line and status bars.

Figure 300. Bitmap (Primary Window) 1 Mbit Display

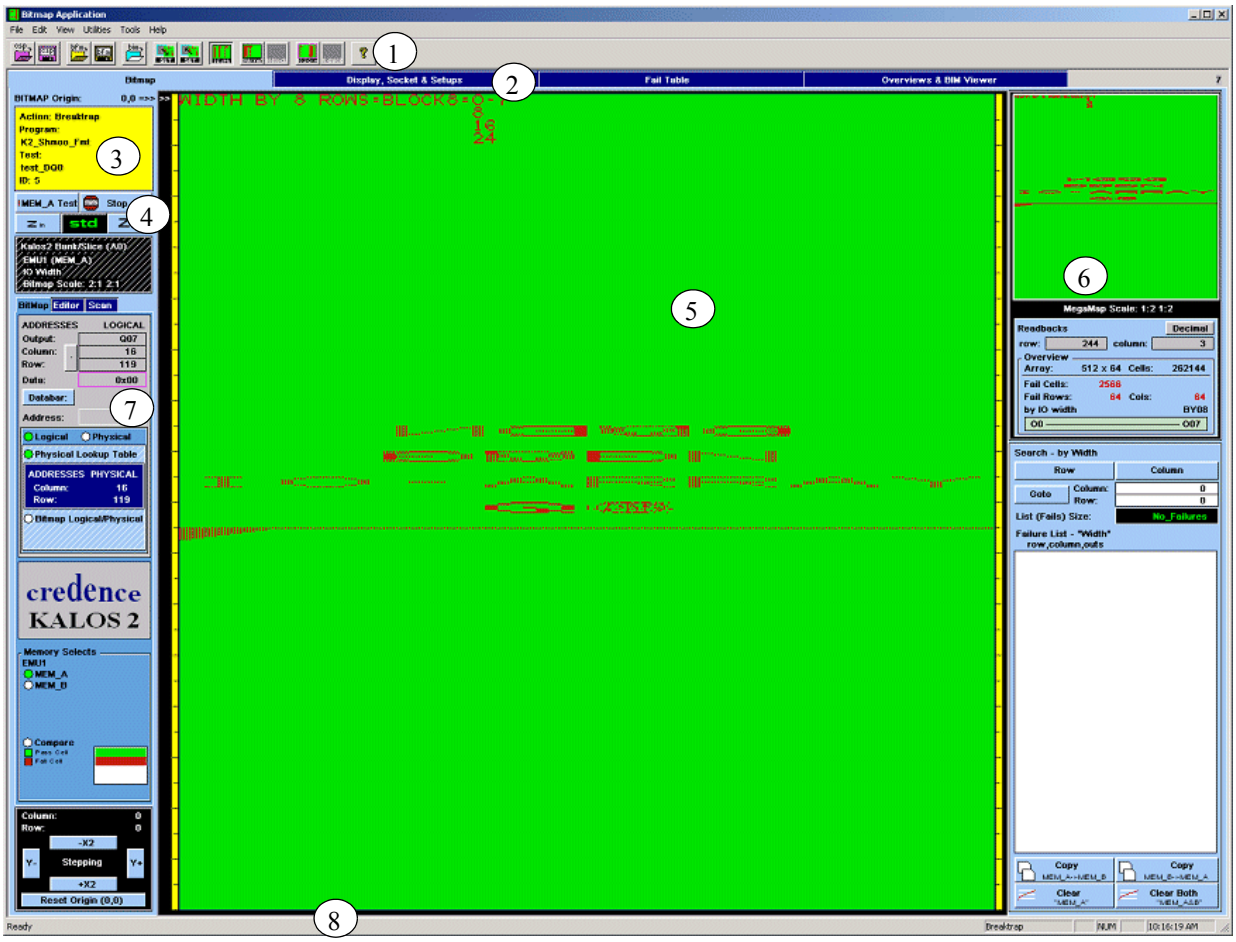
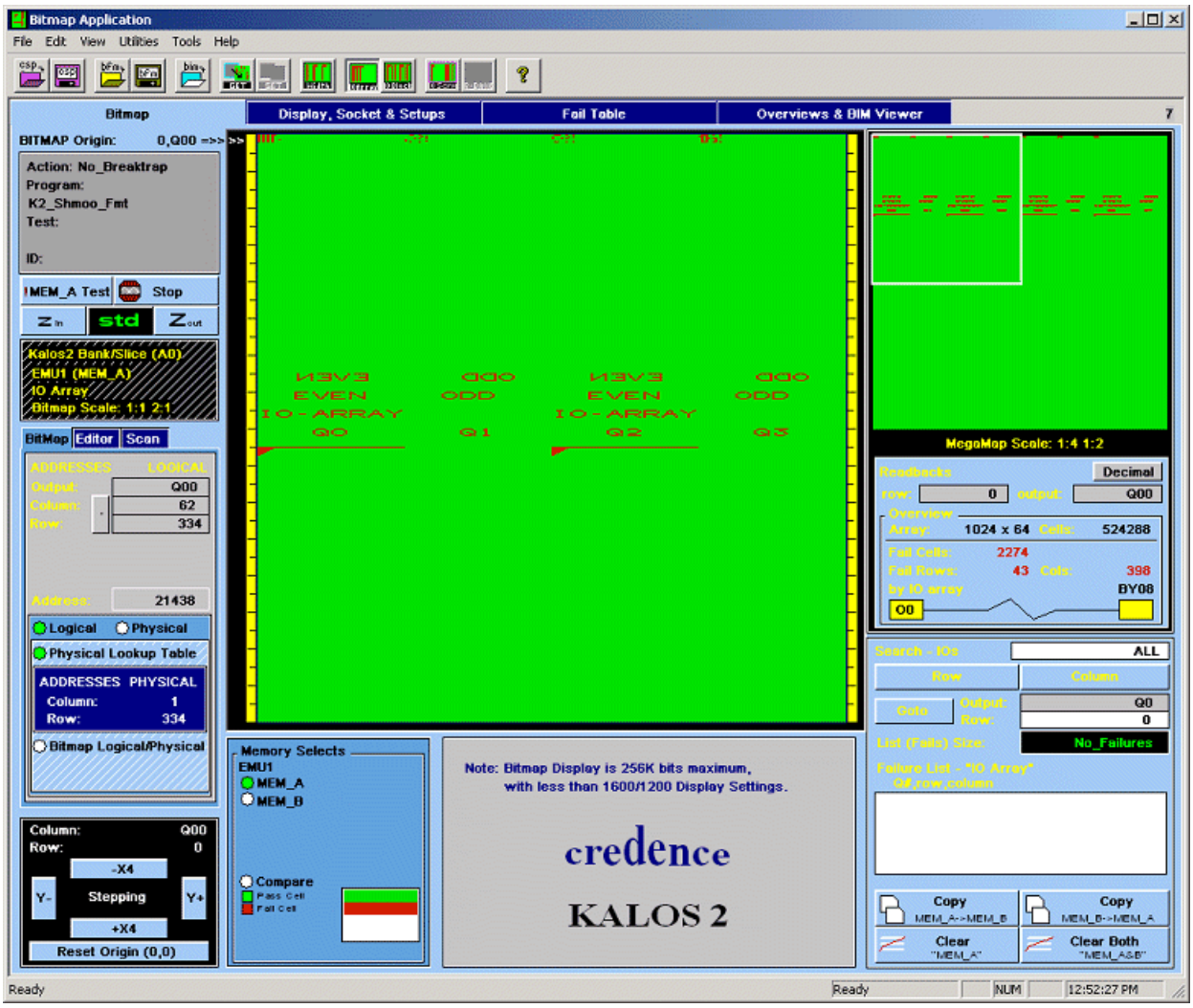


Figure 301. Bitmap (Primary Window) 256 Kbit Display



Menu and Toolbar

The following are descriptions of File menu and toolbar options.

File Menu

The following describes the File menu pulldown options.

Get ECR Data via Mode Selected

Get current ECR data from the specified Kalos 2 slice and its respective hardware.

Set ECR Data via Mode Selected
: Set the application's ECR data to the specified Kalos 2 slice and its respective hardware (width mode only).

Import Setups
: Saves all current setup tables to a file, without deleting the setup tables (*.csp).

Export Setups
: Deletes current setup tables and reads the selected file setup tables into the application (*.csp).

Read *.bfm
: Opens a binary file (with *.bfm extension) and reads the Socket Definition and the ECR data into the application.

Write *.bfm
: Saves selected Socket Definition and the ECR data to a binary file (with *.bfm extension).

Bit Image File (*.bfm) reader
: Opens a previously created *bim file.

Exit -
: Close the tool and all windows associated with it.

NOTE — The *.bim file is a KTL generated file type used for bitmapping; either KLA (third party) or Kalos 2 Bitmap application.

Toolbar

The Bitmap toolbar is an arrangement of graphical buttons that when clicked send messages, as do menus and keyboard accelerators, for requested functions of the Bitmap tool. Below are definitions for the toolbar buttons (see Figure 302).

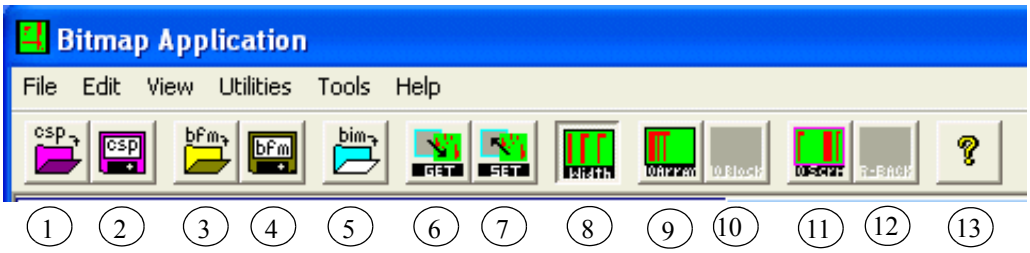
1. Import Setups - (same as the above File menu definition).
2. Export Setups - (same as the above File menu definition).
3. Read *.bfm - (same as Read *.bfm above File menu definition).
4. Write *.bfm - (same as Write *.bfm above File menu definition).
5. Read Bit Image File
6. Get ECR via Mode Selected - (same as Get ECR Data via Mode Selection File menu definition above).
7. Set ECR via Mode Selected - (same as Set ECR Data via Mode Selection File menu definition above).
8. Width Bitmap - width display.
9. Array Bitmap - array display.
10. Array Blocked Bitmap - block array display.

11. IO Scrambler - I/O positioning.

12. Readback Expansion - read-back override.

13. About - displays the Bitmap *About* dialog box.

Figure 302. Bitmap Toolbar



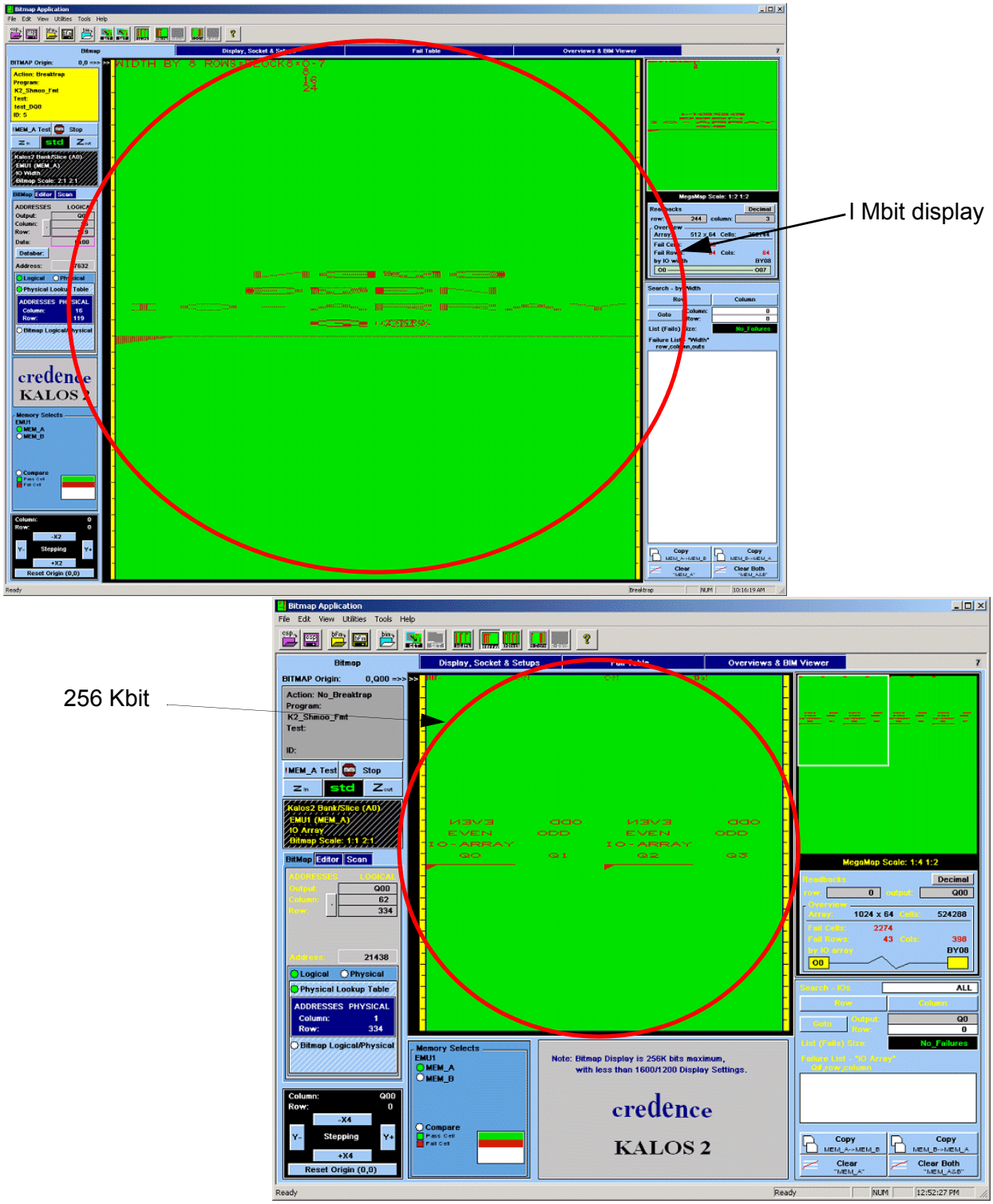
Bitmap Property Page

The Bitmap Application provides two (2) display options, as shown in Figure 303, dependent upon the system monitor settings:

1600 x 1200 1Mbit display
1280 x 1024 256 Kbit display

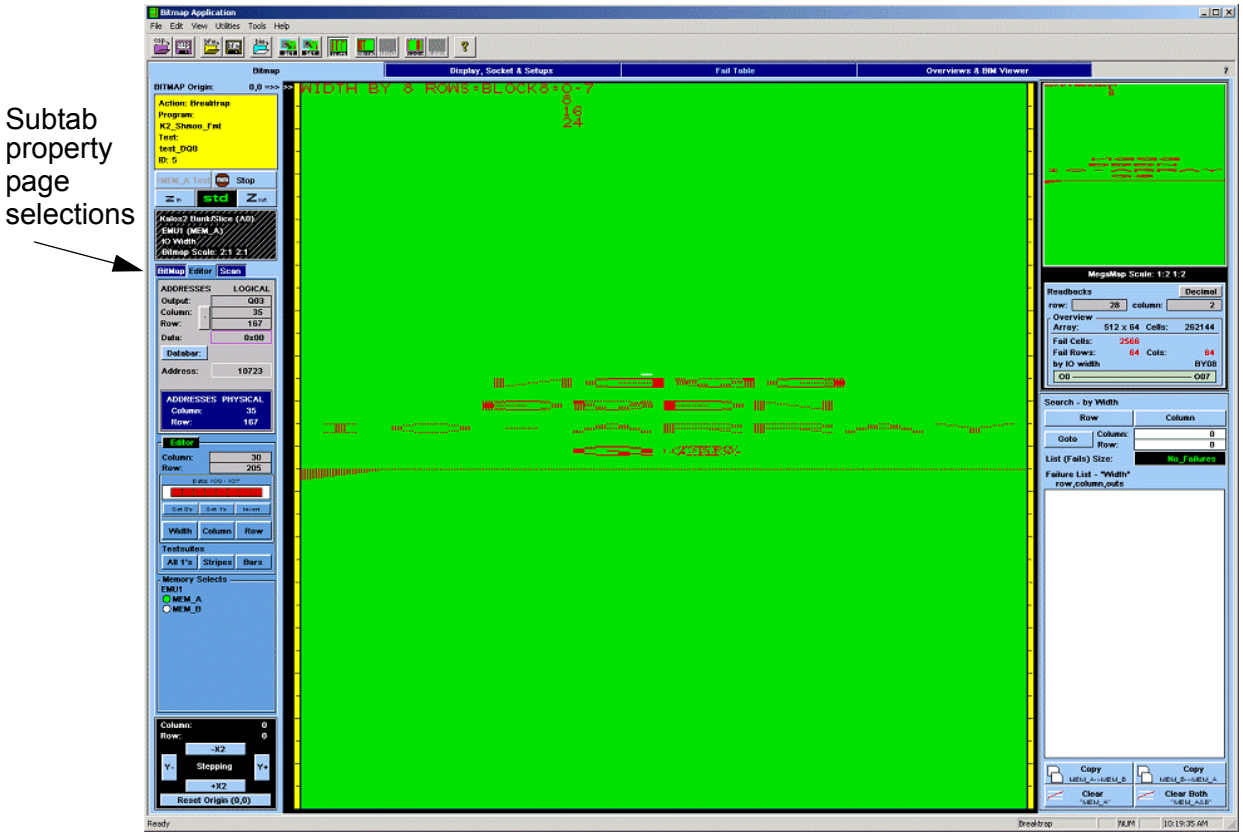
NOTE — Any setting below 1600 x 1200 but greater than 1280 x 1024 will configure to 1280 x 1024.

Figure 303. Bitmap Property Page (Bitmap and Mega Options)



The Editor (property page) subtab (see Figure 304) allows the user to change the bitmap by width, row, or column. This option is normally used to generate test suites, however it can be used as a compare feature by highlighting specified areas.

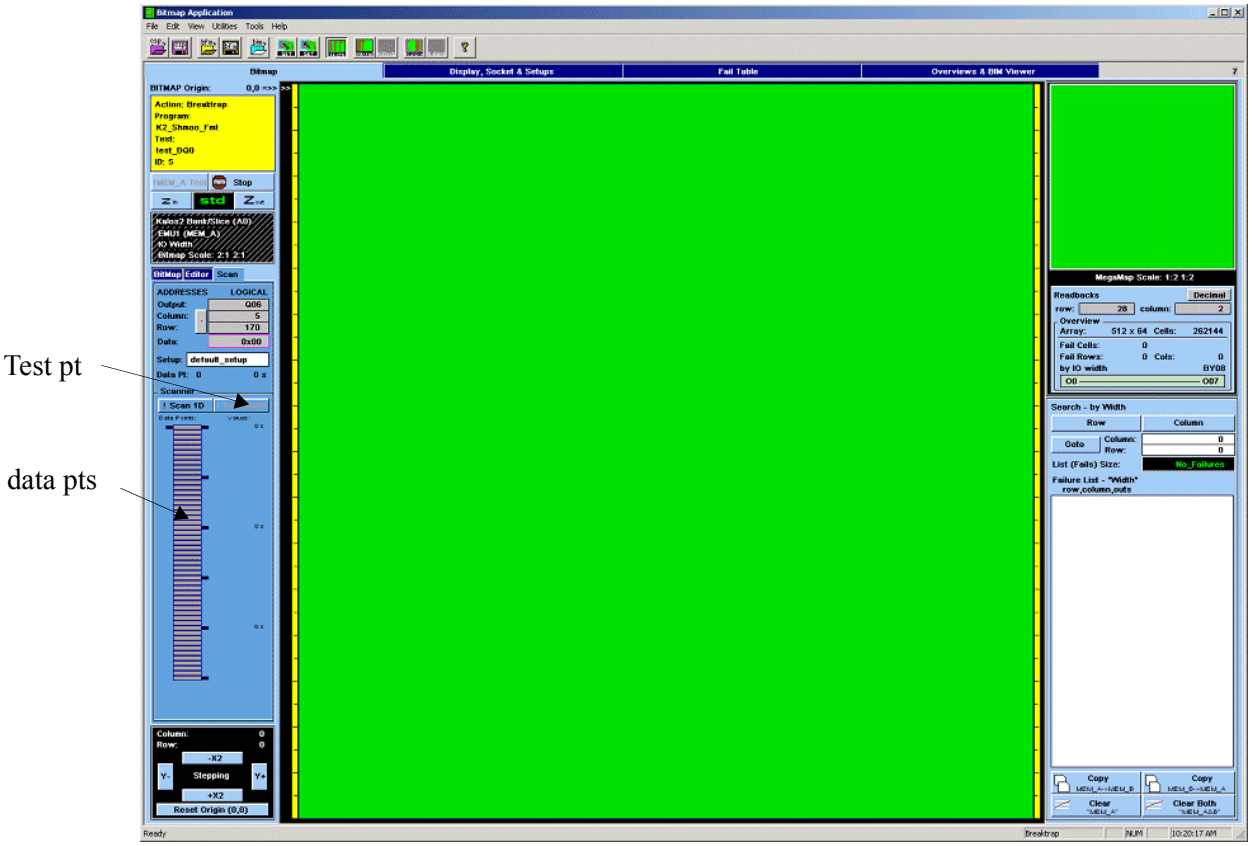
Figure 304. Bitmap - Editor



The Scan (property page) subtab allows operations for executing a Setup scan (1D Shmoo plot). The Scan operation consists of two steps for gathering and displaying Bitmaps. The First step is to execute a 1-D Shmoo plot, using the selected Setup Variable parameter. Then the user must select a datapoint on the visual 1-D plot and re-execute (single point) the selected point. If the selected point has failures, it gets current data from the selected Failed Memory and displays the results to the Mega and the Bitmap using the defined display settings.

In Figure 305, the Bitmap Scan shows the initial control for the viewer's dimensions. Activation of these operations are available by way of the subtab property page, *Display, Socket & Setups* selection. Breaktraps settings are required for this operation. The breaktrap conditions are highlighted on the Bitmap property page.

Figure 305. Bitmap - Scan



Executing the scanner does not destroy the current Bitmap. Only when a data point value is set and the point test (Test pt) is executed does the Bitmap Application tool become updated.

Definition - Display, Socket & Setups Property Page

The Display, Socket & Setups (Definitions) property page allows the user to get online. If the Online Socket File is being used, the device program controls the Bitmap configurations, whereas the *Display* feature allows the user to override the socket setting of the DUT program.

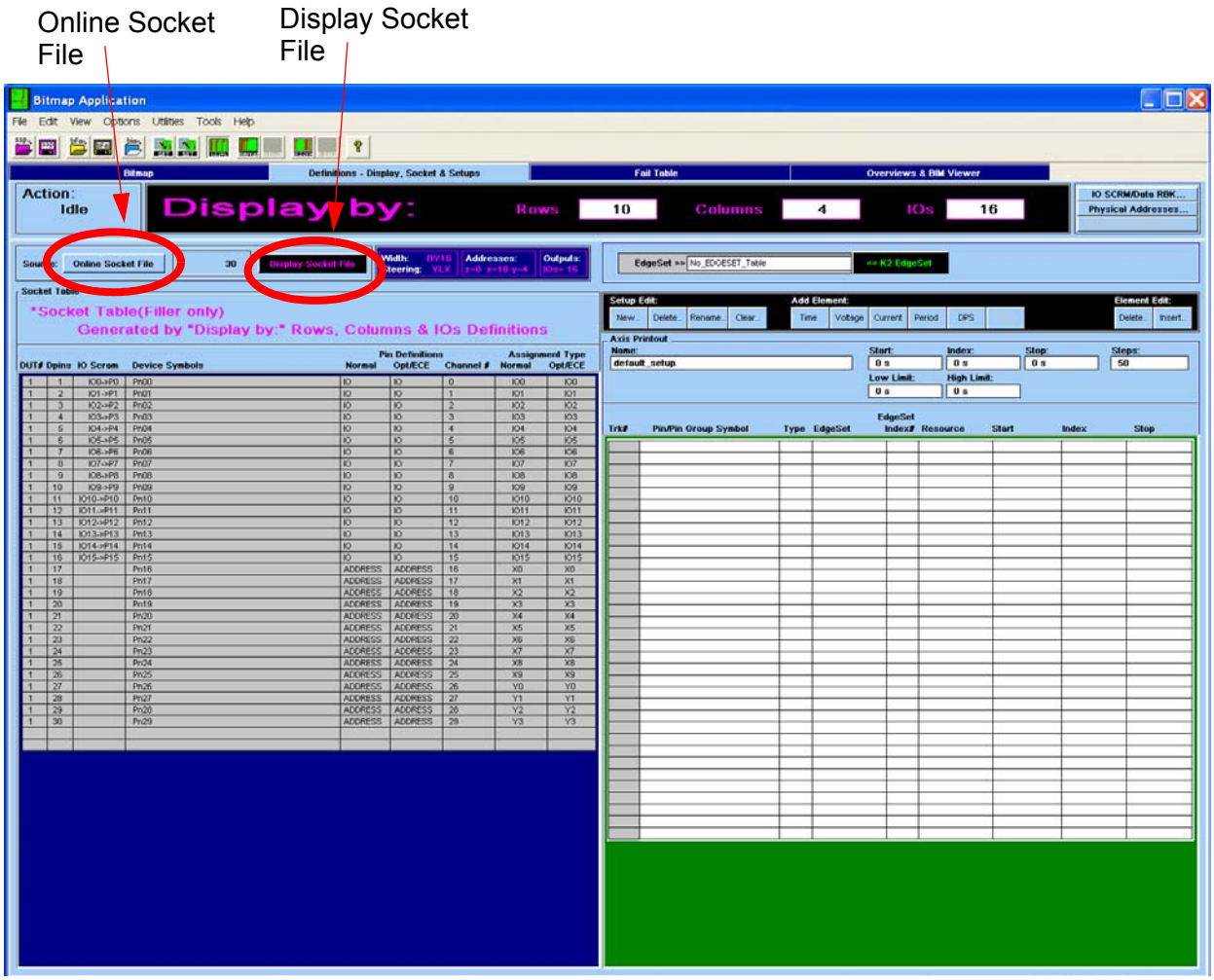
NOTE — The Online Socket File cannot be modified directly, but can be modified by the *Display* feature of the Bitmap tool.

The Display, Socket & Setups property page, shown in Figure 306, provides a viewer that displays the socket file definition and setups of the initialized tool.

The *Display by* socket definition has no relationship to any device type. Its primary use is to ensure that the application is initialized with predefined conditions. The Display Socket File button updates the display by row, column, and IO selections to the socket table.

NOTE — If the Display by socket file is compatible, a socket table is generated in the display, however it has no relationship to the socket table.

Figure 306. Display, Socket & Setups (Definitions) Property Page



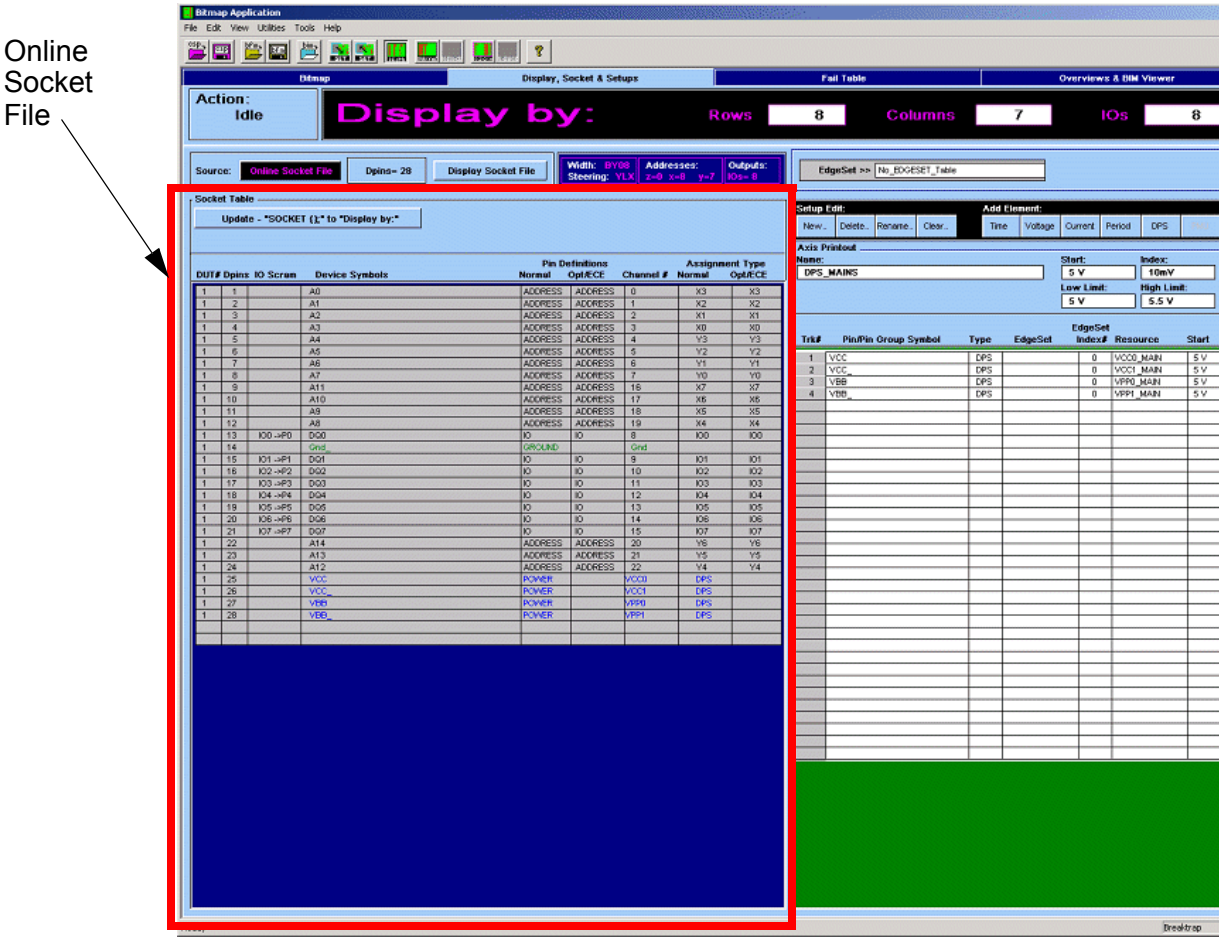
NOTE — The Display Socket File property page condition has no interactive control operations.

Online

The *Online Socket File*, shown in Figure 307, provides a viewer that displays the socket definition of the currently loaded program file. This section of the property page is divided into three areas: display area, socket table, and scan setup area. Notice the Socket Table area is a read only display of the current socket file.

The socket table display area is the text view of the current socket definition. The first four columns show the device information: DUT, DPin, IO Scram, and Device Symbols and the type of function of the Dpin. The remaining columns show the Kalos 2 system pin definitions, channel number, and assignment type.

Figure 307. Online Socket File Property Page



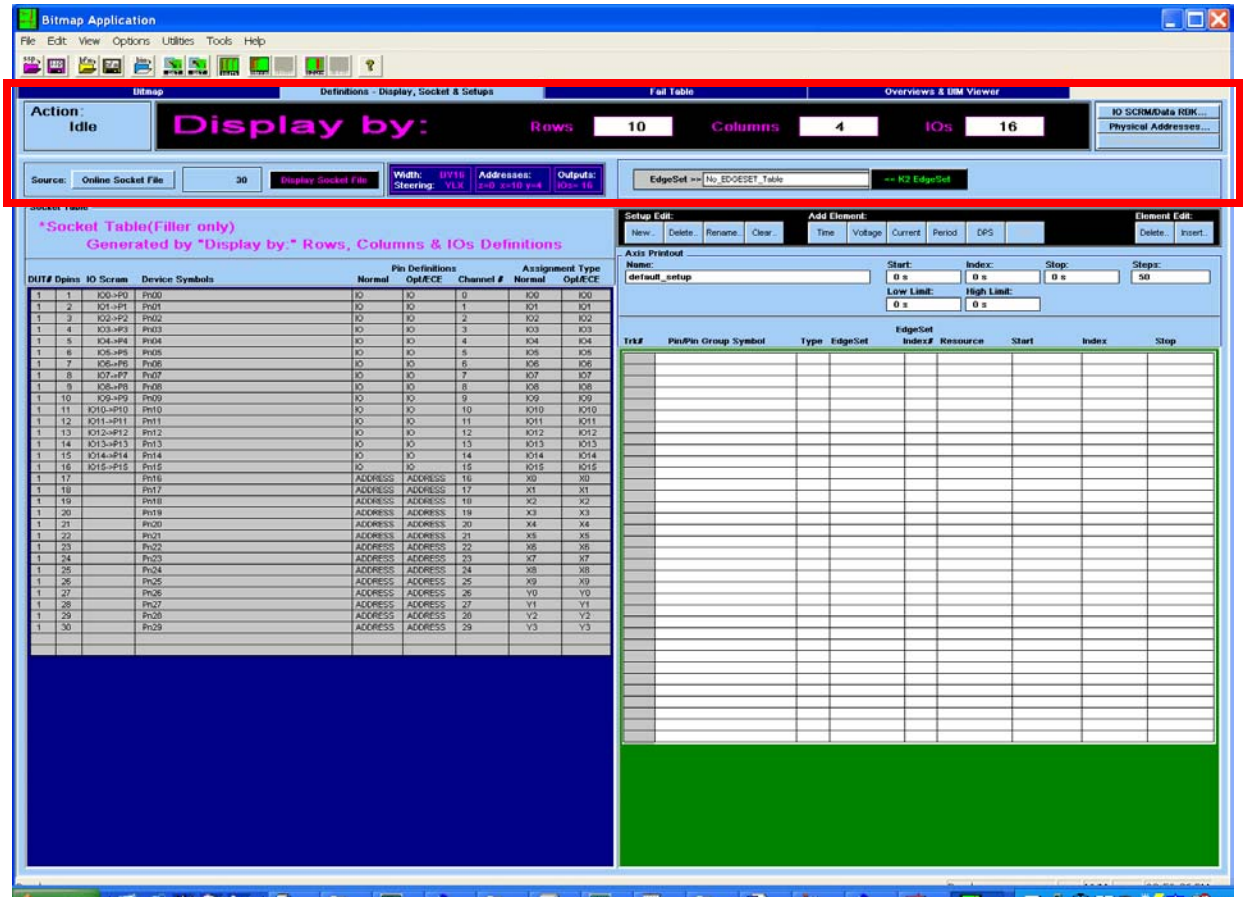
Display

The *Display Socket File*, shown in Figure 308, provides a bitmap display that allows you to configure the bitmap to the display by parameters (rows, columns, and I/O's). Clicking on the Display Socket File button updates the display to reflect your selections.

The socket table has multiple uses, with the main use of reading a *.vlg file into the tool to check and ensure pin and/or pingroups are in sync in the Setups.

Besides providing a compare table for the internal checks, this property page allows for Offline generation of Setups with validity checking.

Figure 308. Display Socket File Property Page

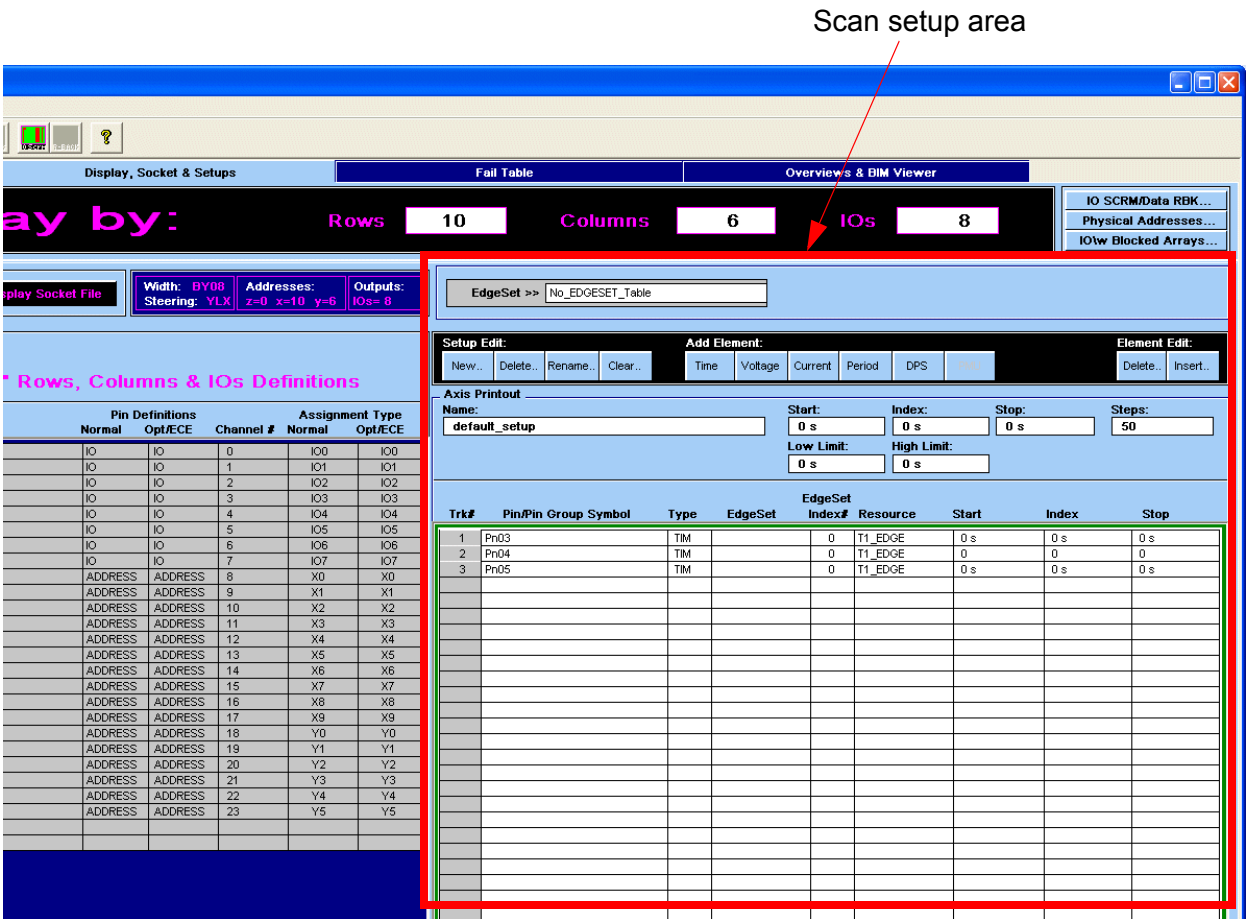


Setups

The Setups area of the Bitmap Application property page, shown in Figure 309, provides for scan editing functions. The test variables setups are the same as defined by the Kalos 2 Shmoo and Value Log tools. This allows the setups to be interchangeable between the tools.

Editing functions that define variable setups (1-D shmoos use only one setup) are performed here. A spreadsheet containing data fields for user input of values that define the variable setups, used with the scan function of the Bitmap Application, is shown in Figure 309.

Figure 309. Scan Setups Property Page



The minimum setup consists of the Axis Printout (METE) variables. These include parameter name, start value, index value, stop value, and number of datapoints (steps) to be executed from the start value.

Every axis setup has two edit areas: axis printout and system resource variables. The difference between them is the axis printout is not system related, therefore the values are not checked for boundary limits.

NOTE — On input, the system checks resource variables against their respective hardware limits.

New, Delete, Rename, or Clear operations for the selected setup are accomplished by way of the menu bar->Edit selection or by way of the pop-up menu, activated by right mouse clicking in the table area.

Modification of the element row contents is performed by way of the a pulldown lists and/or text edit boxes. Both are activated by a single left mouse click in the respective table area.

NOTE — As with all Kalos 2 applications, any field that is white in color can be edited, while grayed-out fields or options are either read-only or unavailable.

The METE and all tracking parameters have individual start, index, and stop values with a common steps value. Although they all have entry points, only the following equation is used for each parameter entry: start value plus index value times step number equals the stop value.

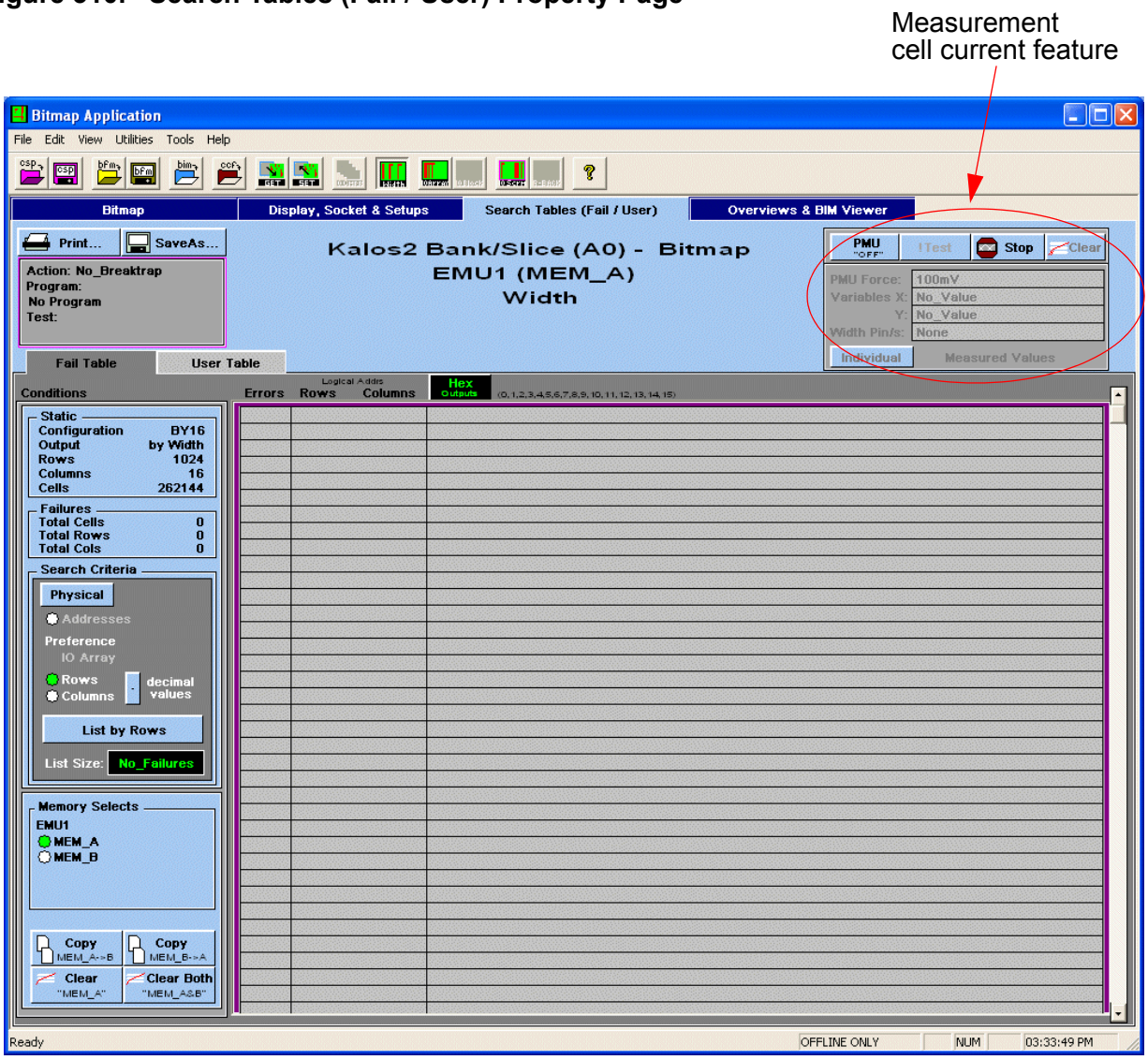
If the user wants to control the parameter range by inputting the stop value instead of the index value, then the step number must be entered before any stop value entries. Changing the step number or the index value changes the respective stop value.

Search Tables (Fail / User) Property Page

The Search Tables (Fail / User) property page is used to search and display failures. Physical addresses of failures are listed in a text type table. The error is listed by row or column preference, selected from the Listing Criteria option, as shown in Figure 310.

The measurement cell current from the bitmap feature allows the user to measure cell current at a failing address using the system PMU. Note that there must be syntax within the pattern to allow this feature to work. Also, a breaktrap setting of *BreakOnSeq* must selected by way of Front Panel.

Figure 310. Search Tables (Fail / User) Property Page



Overview & BIM Viewer

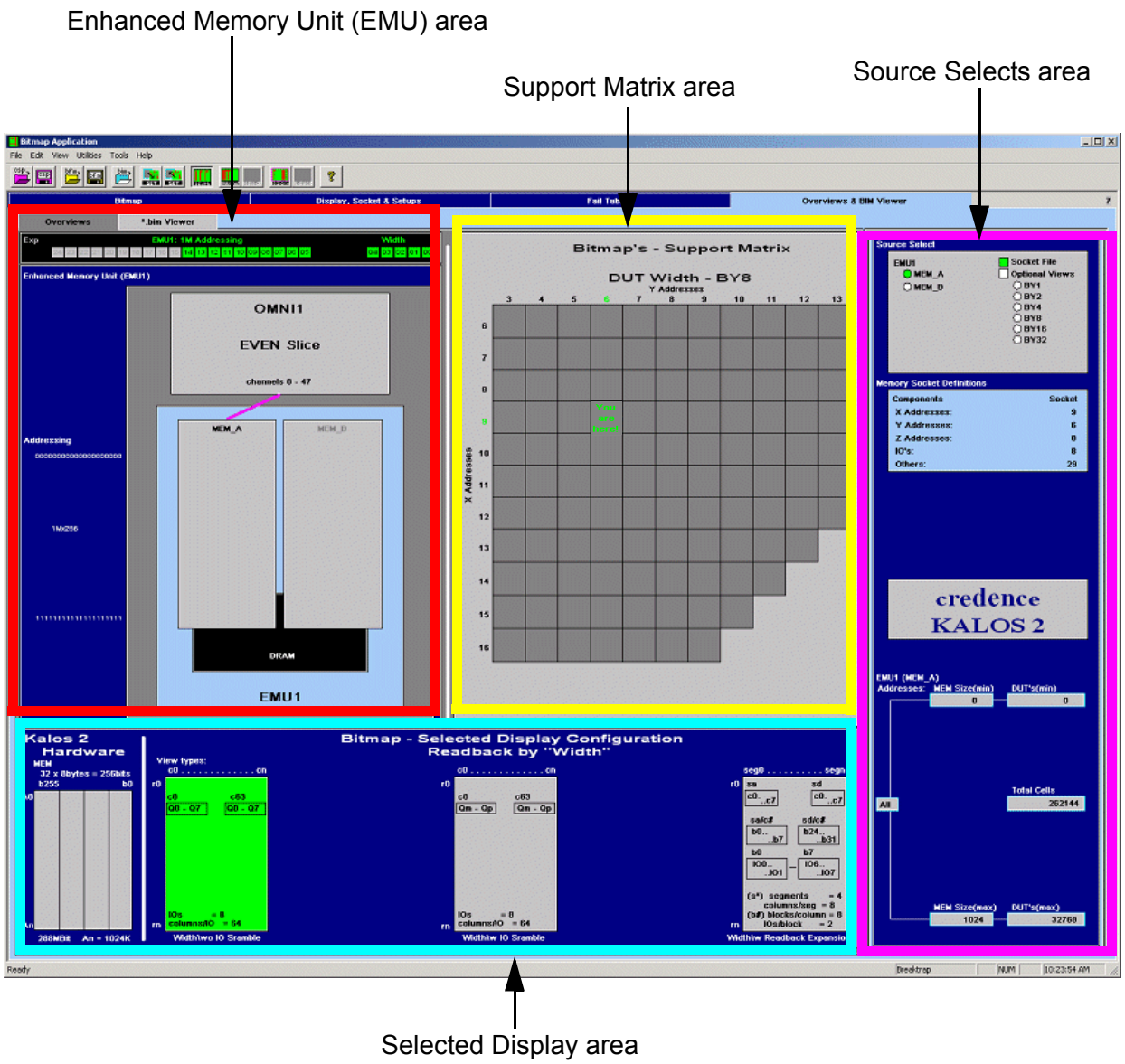
The Overview & BIM Viewer property page, shown in Figure 311, is a view only (overview sub-page) display of the Kalos 2 SRAM physical layout. Users can select either the Socket File definition or the Optional Views in the Source Selects area, the right hand side of the property page, to see the configuration of the SRAM. The Block Diagram window, depicted in the Enhanced Memory Unit (EMU) area (left side of the property page), shows the layout of the SRAM. The Support Matrix area, in the center of the property page, shows what the Bitmap Application supports. The Selected Display Configuration area, in the bottom center of the property page, shows the current selection of a bitmap with read-back diagrams.

NOTE — The BIM viewer has interactive control of Bitmap configuration and display settings.

The base of the SRAM conditions is the current socket definition. If the width of the device being represented is smaller than the definition of the original socket definition, a pop up message informs the user that the configuration is not supported.

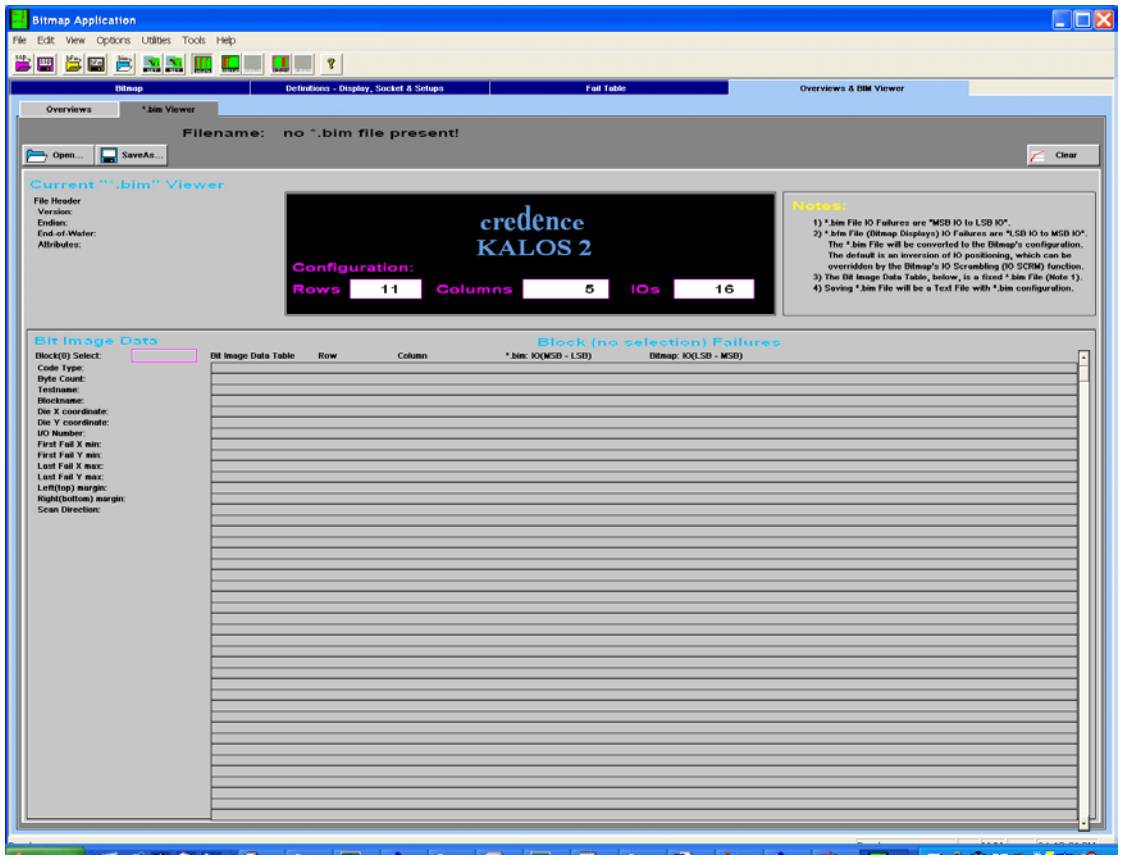
NOTE — The Overview & BIM Viewer property page (Overview sub-page) has no interaction with the Bitmap operations.

Figure 311. Overview Property Page - Block Diagram



The *.bim Viewer (subtab) property page, shown in Figure 312, allows the user to load and view a .bim file. Text block information is read, bitmap can be viewed, or users can return to the top level bitmap to see the graphical representation. Editing functions cannot be perform on this page.

Figure 312. *.bim Viewer



BitPower

BitPower tool is an optional application that allows the user to quickly and easily analyze failed bit information collected at wafer sort. Features include:

- Compresses and consolidates bitmap files into one BitPower file per wafer.
- Converts electrical addresses for failing bits into accurate topological addresses and physical mapping.
- Converts and displays bitmap files for quick and easy identification of failed bit patterns at the wafer, die, and sub-die levels.
- Provides a graphical user interface for easy comparison of test results, wafers, and die and wafer lots.
- Increases and scales wafers and individual die.
- Displays bin types for classification.
- Allows users to change device types by resetting die configuration and wafer description.

The BitPower system works with bitmap files generated during the wafer sort. The system consists of a group of applications that perform various functions to convert data and analyze bit failure patterns.

For detailed information on using the BitPower tool, refer to the *BitPower™ Analysis System User Manual*, supplied with the application.

The BitPower tool is launched by clicking on the *BitPower* icon (see Figure 313) or it can be selected (launched) from the Tools menu item.

Figure 313. BitPower Icon

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A

GLOSSARY OF TERMS

This glossary defines terms particular to Credence test systems, as well as terms specific to ATE applications. These terms appear throughout all Credence high-performance tester manuals.

Numerics

A

active load A programmable circuit that acts as a pullup or pulldown load when connected to a DUT pin.

active test site An operational test site that has tester channel numbers present in the pinlists of the test program. A multisite device test starts with all operational sites active, as determined by a prober or handler device interface. If a device fails, its site is deactivated; that is, its channel numbers (pins) are removed from the pinlists. At the end of the test, all sites are activated again.

ADC Analog to digital converter.

APG Algorithmic pattern generator.

API Application programming interface. A collection of functions or classes that are written in C or C++, or another programming language.

argument A value or address passed to a function at the time of call; also referred to as actual parameter.

ASIC Application specific integrated circuit.

autorange The change of the measurement range by an automatic instrument so it can report with best accuracy a quantity at its input.

B

bidir — Bidirectional access. Input/output, or I/O; used in phrases like *bidir pin*.

board — A single Kalos tester circuit board.

board controller — The dedicated controller for each Kalos board. It is an Intel Pentium microprocessor with 32-bit register-based RISC architecture. The Test Program Executor portion of the Kalos Test Language software resides on each board controller.

breakpoint — A point in a program where execution is suspended so that one may examine partial results.

C

channel — The tester functions and the path through a pingroup card and DUT fixture dedicated to one DUT pin.

characterization test — A series of tests designed to determine the operating regions and reliability of a device under varied operating conditions.

chip — Jargon for a packaged device; a synonym for die or integrated circuit (IC).

clamp voltage — A fixed voltage coupled by a diode or its equivalent to limit the voltage excursion of a transition or a current supply.

CMOS — Complementary medal-oxide semiconductor.

comparator — A circuit whose output is a digital logic level that depends on whether its input signal is above or below a threshold at a specified time interval.

compare — Application of functional data to a comparator in order to obtain the response.

compliance voltage — The voltage range a current source or sink can produce within its constant current specifications.

continuous active load — An active load for which arbitrarily specified voltage-current pairs are corrected from key pre-calibrated points by interpolation on the characteristic curves of the pullup and pulldown FETs.

cycle time — The time duration from the start of one cycle to the start of the next.

D

DAC Module Digital-to-analog converter module. This module works along with the level ASICs to control pin levels for all of the tester channels.

data collection The collection of selected information in a file during a specified operation.

data logging The recording of selected information during a specified operation, such as data recorded during a device-test run.

data reduction The transformation of raw data, such as that logged during a device-test run, to human-usable forms, such as graphical representations and tables.

DBM Data buffer memory. This is a mode for the memory module used during ROM testing. In DBM mode, the memory module supplies non-algorithmic data based on a address provided from the PG.

debugger A process used for test-program development, device characterization, incoming inspection, and production-floor troubleshooting.

DFT Design for test.

DG Data generator.

DGRAM Data generator RAM.

diagnostic tests Tests intended to determine the cause of a possible malfunction and to suggest a repair strategy.

die A piece of semiconductor with circuitry fabricated on it; one location on a wafer; compare chip.

diode bridge A circuit contained within the PE chip. The purpose of the dynamic or I load is to provide accurate device loading to the DUT. The I load is a true constant current source that provides a user selectable IOH and IOL value.

DPS DUT power supply.

DRAM Dynamic random access memory.

driver The circuitry that adds voltage levels to input signals and applies the results to a DUT pin.

DUT Device under test.

DUT fixture A circuit board that interfaces the test head to a device-under-test (DUT) socket, a probe card, or a connector for a device handler. It has pads to mate with the pogo pins on the pin-group cards in the test head and includes power terminals, signal lines (often microstrip), and connections for loads.

E

EBD Binary file format for vector data.

EBNF Extended Backus - Naur form.

ECR Error capture RAM. Memory module responsible for mirroring the DUT and capturing the fails using device address as an index.

edge An abrupt voltage or current change.

edge-placement accuracy The precision within which an edge can be placed relative to a reference.

EMU External memory unit. Comprises SRAM, DRAM and EMU controller.

EOL End of lot.

EOT End of test.

EOW End of wafer.

error A discrepancy between an expected value and a measured value.

error capture The collection of a specified group of functional vectors upon detection of a functional error.

F

file name Part of the identification used to locate a file on a volume.

FLASH A high density EEPROM.

force To stimulate DUT pins with formatted pattern data.

format To produce a waveform from pattern data and timing information in accordance with a format mode.

FSET Format set - referring to driver formats.

functional preconditioning Setting a logic device (for example, a counter) to a desired state by applying stimulus (sequencing through functional test vectors) and checking output until the desired state is reached. Also called match mode or loop-until-pass.

functional test A process that applies pattern vectors to a device and checks the output to determine that the device is operating according to its truth table.

G

go/no-go test A test with minimum and maximum limits that stops on the first error without performing any diagnostics, characterization, or actual measurements other than limit checking.

GPIB General purpose interface bus. Defined by ANSI/IEEE 488 - 1978.

guard band **1.** (Device testing) Adjustment made to a DUT's test specification to take into account test-system accuracy, repeatability, reproducibility, and correlation.

2. (Wafer probing) Portion of a pad (on a die) taboo to a probe. During a probe-mark inspection, probe marks encroaching on the guard band are counted as bad.

GUI Graphical user interface.

H

Hex system A Kalos system with 16 boards installed in the test head.

hexadecimal notation The representation of numbers in the positional number system with base 16. The sixteen hexadecimal digits are usually represented by 0-9, A-F.

I

I/O channel An input/output tester port that is capable of both stimulating a device pin and monitoring a response from the same pin.

inhibit To turn off a driver, placing it in a state that approximates an open circuit.

K

Kalos Name of test system - however the word itself is a greek word for beauty, usually applied to masculine objects. It has overtones of *usefulness*.

KBI Kalos test program binary interface. This is the executable test program file, with file name extension .kbi.

KITE The Kalos software environment. An acronym for Kalos interactive testing environment.

KNET Kalos network software functions and code.

KPC Kalos pattern compiler.

KPL Kalos pattern language.

KTC Kalos test program language compiler.

KTL Kalos test language.

L

LAN Local area network.

level ASIC One of several custom CMOS chips on the Kalos. The Level ASIC contains six tester channels worth of sample and hold circuits for controlling pin levels (VIH, VIL, VOH, VOL, IOH, IOL, VTH, and VIHH).

library A collection of routines, data, or other material in a file from which a user can draw for use in a project such as a test program.

link	1. (scan) The data fed to a scan pin on one scan clock cycle — the scan equivalent of a parallel vector. 2. To join together two or more separately compiled program modules, usually with additional library modules, to form an executable program.
lot	(device production context) A group of semiconductor devices, usually from the same production run, treated as a unit.
LSET	Level set.
LV	Large vector memory. This refers to the memory module when used in vector testing mode.
LVM	Linear vector mode (PMODE 1).

M

mask	To set a comparator state used to ignore the result of a comparison.
memory module	The memory module, of which there are two per board. This memory can be used for DBM, ECR or Vector testing.
microRAM (μRAM)	The internal memory of the PG ASIC. A user's test pattern is stored in the microRAM of the PG chip.
module	Synonym for Kalos circuit board. Comprises two slices.
multidie probing	Using probes on several dice on a wafer to conduct a parallel test of more than one die at a time.
multisite	Refers to more than one test site on a single test head.
multisite testing	Using a single test program and a single test head with more than one test site to test more than one device either in parallel or in sequence. The sequential test of two or more devices is called a *ping-pong* test.
MUX	Multiplexer.

N

non-volatile	A memory device type that does not require a power source to maintain its data contents.

O

Omni — A highly integrated .18 u CMOS chip comprising timing, formatting, pattern sequencing, and algorithmic pattern generation for 48 I/O channels and 2 utility channels.

operational test sites — Test sites on a multisite test head declared on to the test program. This assures that a test site is usable—no broken socket, channel runs exist. An operator can declare test sites non-operational.

P

PAC — Pin analog controller.

parallel test — Testing more than one device simultaneously using a single test program and a test head with more than one test site.

parameter — A quantity in a function (or subroutine), or at a device port, the value of which is selected according to circumstances. Parameters are distinguished from variables — recorded measurements — and constants — fixed values. A formal parameter is one defined within a function.

parameter file — A data set containing the voltage, current and timing information for a specified test on a particular device.

parametric test — The measurement and verification of terminal voltage and current characteristics at a device pin.

PASM — Pattern assembler/loader.

pattern — The binary data applied to and expected from a DUT during a functional test.

pattern vector — The pattern data applied to and expected from a DUT during one test cycle.

PBI — Pattern binary interface. Files of this type have a .pbi extension.

PE — Pin electronics - mainly the driver, comparator and active load.

PE ASIC — The pin electronics ASIC. Each PE ASIC contains four tester channels and provides driver, dual comparator, and dynamic load circuitry per pin.

PG	Pattern generator. Contains a 2K deep microRAM, several scramble memories and muxing circuitry to get an address or I/O signal to any Kalos pin. Also in the PG are fail counters for ECR mode.
pin	A metal stem connected to circuitry on a chip to enable external access.
pinlist	An array of pin-name/channel-number pairs.
PLD	Programmable-logic device (the target DUT for the tri-level driver).
PMU	Parametric measurement unit.
pogo pin	A kind of spring-loaded pin formed of two small tubular sections joined together with an internal spring and with a contactor formed on the end of the smaller tube; used to contact pads on a circuit board.
programmable logic levels	The signal and reference voltage levels applied to the driver and comparator rails.
PSET	Period set - referring to timing parameters for periods.
PTC	Pull to center; a load tied to a voltage midway between a specified high voltage and a specified low voltage.
PTU	Parametric test unit - used for go/nogo parametric testing.
PVM	A synonym for vector mode.

R

resource	In the Kalos Test Language (KTL), a resource is a component of a test program which contains data to be applied to the DUT.
RISC	Reduced-instruction-set computer.
RS-232C	An ANSI standard interface for interconnecting computers and peripherals such as terminals, device handlers, and wafer probers.

S

SAC System analog controller.

SBC Surround by complement. Precede and trail a force pulse by its complement within a test cycle.

SCAN DFT methodology which uses dedicated, embedded shift registers.

shmoo plot A one-axis or two-axis pass/fail plot of a series of measurements corresponding to plot coordinates, thus showing the operating region for a device for those parameters.

shutdown The (usually graceful) termination of operation-system execution on a processor (or system of processors).

sink current (active load) Conventional current flow into a DUT with the active load as pullup.

sink voltage (active load) Terminal voltage at a DUT acting as current sink.

site A DUT position on a test head with more than one such position.

site number A number that identifies a site location on the test head.

skew The effect of different propagation delays between signal origins and device pins (or other points, for example, probes).

slew rate Rate of change of a voltage or current.

slice One 48-channel component of a Kalos circuit board (module).

socket table In the Kalos Test Language (KTL), a data structure that contains pin maps and pin resource definitions.

source current (active load) Conventional current flow out of a DUT with the active load as pulldown.

source voltage (active load) Terminal voltage at a DUT acting as current source.

spooler A process that queues jobs for background printing (or other tasks).

SRAM Static random access memory.
EMU memory for data generation and error capture.

strobe A signal that clocks a logic state into a latch or D flip-flop. In a semiconductor test, an edge strobe records a comparison result at a specified instant in the cycle; a window strobe records any error occurring during a timed interval.

switch ASIC Another custom CMOS chip on Kalos 2. The switch ASIC serves several purposes. First, it provides for electrical disconnect of the Pin Electronics and the PMU from the DUT. Second, it provides the Vihh drive circuitry, and finally it provides the Thevenin resistive load. There are six channels per Switch ASIC.

T

$T_{ø}$ Time zero—the instance used as the reference for the timed events of a device test during one clock cycle.

terabit Ten to the twelfth (10^{12}) bits.

test specification A document defining the operational parameters of a device.

tester An assembly of apparatus used for evaluating semiconductor devices.

TG The timing generator. Each TG ASIC provides timeset, format and period memories and verniers for six tester channels.

Thevenin load The Kalos 2 contains a variable resistor with a programmable bias supply behind it. This can be used to provide device loading (either as a pullup or pulldown load) or as a source of termination.

time-out An error event that occurs after a maximum time interval for an expected event.

timing set Timing set. The specification of cycle length and edge placements that can be referenced collectively for up to four edges.

TPE Test program executor. A portion of the Kalos 2 test operating system which runs on the CPU of each Kalos 2 board.

trace To monitor the execution of a program and report the sequence of actions carried out.

tristate A high-impedance third state for a device output.

TSET Timing set. The specification of cycle length and edge placements that can be referenced collectively for up to four edges.

U

uRAM Pattern controller micro-RAM.

V

VCH Voltage clamp high - used to clamp the I/O's high voltage.

VCL Voltage clamp low - used to clamp the I/O's low voltage.

vector 1. A parallel vector is the functional logic applied to a DUT during one clock cycle.

2. A scan vector is equivalent to a partition, and uses multiple scan clock cycles. See also *partition*.

VIH Voltage input high, with respect to the DUT. This term, in context of the tester, refers to the drivers output when high.

VIL Voltage input low, with respect to the DUT. This term, in context of the tester, refers to the drivers output when low.

VIOH Voltage/current output high. This term defines the voltage to produce the current for the active load when the DUT is high.

VIOL Voltage/Current output low. This term defines the voltage to produce the current for the active load when the DUT is low.

VOH Voltage output high, with respect to the DUT. This term, in context of the tester, refers to the comparators input when comparing for highs.

VOL Voltage output low, with respect to the DUT. This term, in context of the tester, refers to the comparators input when comparing for lows.

VT Voltage threshold - used to determine the switch voltage point for the active load.

W

wafer	A thin, polished slice of monolithic semiconductor on which an array of die are fabricated.
wafer map	A plot of the viable dice on a wafer showing pass/fail information, parameter variation, or some other characteristic.
waveform	The succession of signal levels applied to the DUT pin after combining pattern and timing information.
workstation computer	The computer located in the Kalos 2 power server which runs the Windows XP operating system and the front-end portion of the Kalos operating system.

Y

yield	The proportion of good devices in a lot or run.

Z

ZIF	Zero insertion force, a kind of DUT socket used for manual device testing.

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